RAILROAD GAZETTE

FRIDAY, OCTOBER 11, 1901.

CONTENTS



## Contributions

### The Brooklyn Bridge.

October 8, 1901.

To the Editor of the Railroad Gazette.

In the published abstract of the engineer's report on the Brooklyn Bridge, the general condition of the structure is reviewed and the broken suspender rods, whose recent fracture caused such alarm, are described as "of ample strength to withstand the tension" to which they are subjected, "and the failure must have been due to some other causes." The "other causes" do not seem difficult to find, and although already described in the daily press, as due "to extreme heat," "to vibration," "to over-straining," etc., one more suggestion may be permissible.

The explanation of these fractures will be found in the fact that the suspenders were made of steel and the screws on them cut with V-shaped threads. This, with the vibration or alternate strains described, is sufficient to cause fracture, after prolonged service.

It is a well recognized characteristic of steel, that when a crack starts, it will creep through the metal, as will a crack in plate glass, by the repetition of slight strains; whether the strains are caused by changes of temperature, by vibration, or by any other influence. These cracks may start from the slightest flaw in the metal, or, as in this instance, from the sharp bottom of a V-shaped thread. To avoid this danger it is customary in more recent practice, either to make such suspenders of fibrous wrought iron, where the fiber will prevent the crack from traveling; or else, when a stronger metal, as steel, is required, to fillet the bottom of the thread, so as to avoid the sharp cut.

The ends of steel pins of railroad bridges, under the vibration of passing trains, have broken off, apparently without strain, and the fracture showed rings of rust, indicating that the pin had broken in small increments.

The fractures of the suspender rods occurred in the thread, and showed similar rings of rust, as in the case of the bridge pin described.

HENRY B. SEAMAN.

### The Barschall Joint and the Congress Report.

New York, Sept. 28, 1901.

To the Editor of the Railroad Gazette.

In connection with the article on "Rail Joints," appearing in your issue of Aug. 30, containing extracts from the discussion of this subject which appeared in the July *Bulletin* of the International Railway Congress at Paris, permit me to draw attention to a few facts, that the article may not be misleading to some of your readers.

The Barschall joint or "Stossfangschiene" (which Mr. Ast refers to as the Rehbein joint) is in use and being thoroughly tested on about 150 miles of track, while Mr. Ast's report covers only the following: Kaiser Ferdinand Nordbahn, about 1½ miles; Swiss Central R. R., about 10 miles; Austrian Southern R. R., about 1½ miles; Mediterranée & Meridionale R. R., about 90 joints; Warschau-Wien, about 20 joints. Making a total of about 14 miles of track. Mr. Ast, of the Kaiser Ferdinand Nordbahn, had the packing pieces cut into sections, instead of making them of one solid piece. The Swiss Central laid the outer rails without fastening them on their metal cross-ties (no tie plates). With these changes, joints cannot possibly have the same efficacy as the original.

The experience of these two roads must, therefore, be excluded from the above total of 14 miles with "unsatisfactory experience." There remain in this class, three roads with a total of about two miles, as against about 140 miles giving eminently satisfactory results. If the unfavorable observations on the two miles were in fact a fault of construction, the same defects would necessarily have appeared wherever it has been used; this is not the case, hence the cause must be attributed to other circumstances, viz., poor material or incorrect application. In not one instance has it been shown that the principle of construction of the joint is at fault.

Mr. Ast mentions but one favorable experience with the joint—that of the Berlin City Railroad, and he adds "it must not be forgotten that the conditions there are particularly favorable." He does not say that on other lines of the Prussian State Railroad, where these "favorable conditions" do not exist, the joint has given thorough satisfaction and that the various administrations of these lines have applied to the Minister of Railroads for the funds to equip their sections with this joint. The joints in use on the Pennsylvania Lines, even though made of too soft material, have given satisfaction for the past 3½ years.

Far better results with the joints have been attained where these were rolled to suit the rail section, instead of being cut from rails, as were most of those used to test the principle and construction.

Rolled joints are in use on the Vienna City Railroad, about 50 miles; Kaschau Oderberger Railroad, 12 miles; Mecklenburg-Friedrich Franz Railroad, 12 miles.

Official reports of these roads were published in your issues of May 4, 1900; April 19, 1901, and May 24, 1901. These far superior results are unquestionably due to the narrower running surface (the auxiliary rail sitting more closely to the main rail), and to the hardness of the material.

Mr. Ast and other opponents of the joint claim that the packing piece prevents an independent movement of the different parts. Practical experience proves that even when the surface of the auxiliary rail differs in height with the surface of the main rail, both rails bear together under the pressure of the rolling load, thus giving positive proof that there is an independent movement of the main rail and the outer auxiliary joint rail. This motion is secured by the narrow and rounded bearing surfaces of the filling piece, transversely distributing the weight between the two independent supports.

The construction gives to the suspended joint the necessary stiffness, while preserving at the same time the advantage of the desired elasticity; in other words, it unites the advantages of both the supported and suspended joints, and does away with the defects attributed to both.

In June last the "Reichsgericht" (Supreme Court of Germany) in a suit instituted by the Direction der Reichsbahnen, attacking the validity of patents covering this joint, called upon Messrs. Ast and Koestler as experts.

The court decided that Mr. Koestler's argument, based upon actual experience, was thorough and convincing, confirming the efficiency of the component parts of the joint, and the patents were sustained, notwithstanding the contradictory opinion of Mr. Ast.

M. BARSCHALL.

### The Roadmasters' & Maintenance of Way Association.

The nineteenth annual convention of the Roadmasters' & Maintenance of Way Association (formerly the Roadmasters' Association of America) was held at the National Hotel, Washington, D. C., Oct. 8, 9 and 10. The first session, with about 40 members present, was called to order by President Meade at 10:30 o'clock Tuesday morning. His address consisted of a brief review of the work of the association from its formation in Chicago in 1881 to the present time.

Twenty-five new members were elected. The report of the Secretary and Treasurer showed a balance on hand of $526.65.

The first subject discussed was "Tie Plates," a committee report, in the form of a paper, by J. C. Hechler, General Roadmaster of the Denver & Rio Grande. An abstract will be found in another column. The discussion was opened by Mr. R. P. Collins (N. Y., N. H. & H.), who was followed by Messrs. C. Buhrer (L. S. & M. S.), T. S. Cafferty (A., T. & S. F.), C. McEniry (B., C. R. & N.), E. A. Theed (L. S. & M. S.), G. W. Merrell (N. & W.), J. L. Single (L. I.), W. B. Summersett (C. C.), C. E. Jones (C., B. & Q.), J. M. Meade (A., T. & S. F.), and W. J. McClaren (N. & W.). The various makes of tie plates included in the paper were referred to favorably in the discussion and the Goldie plate also was especially commended for its efficiency. To sum up the discussion, it may be stated that in the opinion of those present the use of some tie plate is unquestionably desirable; but the members did not agree with a statement in Mr. Hechler's report that it is good practice to spike plates to the ties, allow passing trains to embed the plates and later drive the spikes home by hand. Plates should be securely fastened to the tie before being put under rail and spiked in proper position before a train is allowed to pass. Plates of too great length are apt to buckle; the spaces beyond the first and last spike holes should be not more than ¾ in.

The second session was held at 2:30 o'clock in the afternoon and opened with a reading of the committee report by J. E. McNeil (S. C.), on "Does Chemical Treatment of Ties Increase the Hardness of Wood and the Holding Power of the Spike?" This is printed by abstract elsewhere. In the discussion I. O. Walker (N., C. & St. L.) stated he had understood spikes held better in a treated than in an untreated tie, but that when once started would work out more quickly. He had used Carbolineum Avenarius on some bridge ties, but found no trouble of that nature. It was thought that if the tie is allowed to season after treatment no difficulty would be found. No conclusions could be reached from the discussion.

The committee on "Surfacing Track," M. Sullivan (M. C.), made no report.

The committee report on "Tamping Ties" (see abstract in another column) was then read. It was the unanimous opinion of those present that the report represented good practice and left no room for discussion.

"Burned Clay Ballast," by W. Shea (C., M. & St. P.), was read and discussed. There was considerable difference of opinion as to whether, because of the nature of burned clay (1) ties are held in place securely; (2) its effects on the life of ties (see abstract of report). It appears that burned clay ballast absorbs rather than sheds water, and also dries quickly. The use of burned gumbo soil of good quality is recommended, provided the foundation for the ballast is of a character to readily get rid of water absorbed by the burned clay; but the members could not agree with Mr. Shea that this kind of ballast would preserve the ties. The cost of maintaining burned clay, over stone, ballast was given as from 33⅓ to 50 per cent.

The two papers on "Are the Best Results Obtained From the Use of Broken or Square Joints?" by L. Bradley (A., T. & S. F.), and F. J. Allen (C., B. & Q.) were read and discussed. (See the abstract in this issue.) It was the opinion of those who took part in the discussion that unquestionably broken joints were preferable for both single and double track; but because of the importance of the subject it was suggested that copies of the papers be mailed to some absent members for written discussion.

A paper by G. E. Hayward (C., St. P., M. & O.) on "The First and Latest Problems in Railroad Construction," was read. This called for no discussion.

Mr. C. Buhrer (L. S. & M. S.) described, in the form of a paper on "Steel Ties Constructed From Old Worn Out Steel Rails," his system of converting old rails into steel ties. Eight ties were laid on the L. S. & M. S., at Sandusky, Ohio, in May, 1900, and in May of this year 150 more were put in the track at the foot of a grade, on a 1 deg. curve, near Sandusky. They were spaced 21 in. apart and laid in sand ballast. Mr. Buhrer stated that to the present time the ties have received considerable less attention than the wood ties on an adjoining track; that the cost of maintaining his tie is considerably less than for a wood tie. He has received authority to place 3,000 more in track next spring. No figures were given to show the increase in cost over a wood tie.

At the session of Wednesday morning the paper on "The Use of 45-Foot Rails," by Mr. F. R. Coats, was presented and discussed.

The following officers were elected: President, I. O. Walker, Assistant Engineer, Nashville, Chattanooga & St. Louis; First Vice-President, F. J. Allen, Roadmaster, Chicago, Burlington & Quincy; Second Vice-President, James Sweeney, Roadmaster, Chicago & Eastern Illinois; Secretary and Treasurer, Charles McEniry, General Roadmaster, Burlington, Cedar Rapids & Northern. Members of Executive Committee re-elected, except that W. J. McClaren, Roadmaster, Norfolk & Western, succeeds G. W. Merrell. Milwaukee was selected as the place for the next meeting.

EXHIBITS.

The exhibits were placed in two rooms on the ground floor of the National Hotel. The following firms had displays:

Armspear Mfg. Co. (successor to Railroad Signal, Lamp & Lantern Co.), New York.—Samples of the Armspear switch and semaphore lamps.

Best Mfg. Co., Pittsburgh, Pa.—Sectional model of the Gulland automatic and counterbalanced valve.

Buda Foundry & Mfg. Co., Harvey, Ill.—The Ware tie plate surfacer and gage and Buda, Paulus and Wilson track drills.

Cambria Steel Co., Johnstown, Pa.—Full size model of the "100 per cent." rail joint.

Chisholm & Moore Mfg. Co., Johnstown, Pa.—Models of the American (boltless) standard rail joint; also rail braces.

Continuous Rail Joint Co. of America, Newark, N. J.—Photographs showing application of the continuous joint to rails on the Boston elevated and subway roads.

Dilworth, Porter & Co., Pittsburgh, Pa.—The Goldie spike, in soft steel; Goldie shoulder claw tie plate and the Glendon tie plate.

Dressel Railway Lamp Works, New York.—Switch and signal lamps.

Eureka Nut Lock Co., Pittsburgh, Pa.—Samples of the Eureka nut lock.

Eyeless Tool Co., New York.—Track tools.

Fairbanks, Morse & Co., Chicago, Ill.—Models of the Barrett track and bridge jacks and Sheffield hand-car.

William Goldie, Jr., & Co., Pittsburgh, Pa.—Samples of the Goldie tie plug.

Graham Combined Guard Rail & Frog Brace Co., Roanoke Va.—Model of a new combination guard rail and frog brace.

Hussey, Binns & Co., Pittsburgh, Pa.—Scoops and shovels.

Iron City Tool Works, Pittsburgh, Pa.—Track tools.

Lidgerwood Mfg. Co., New York.—Photographs showing application of the Lidgerwood rapid unloader to railroad and other engineering work.

National Lock Washer Co., Newark, N. J.—Samples of the National lock washer.

A. O. Norton, Boston, Mass.—Models of Norton jacks.

Page Woven Wire Fence Co., Adrian, Mich.—Samples of the Page "coiled spring" fencing.

Pennsylvania Steel Co., Steelton, Pa.—Models of the following: No. 10 spring rail frog; reinforced split switch with

adjustable connecting bar; Long's safety switch stand, and a split switch.

Pettibone, Mulliken & Co., Chicago, Ill.—Rail braces and switch stands.

Ramapo Iron Works, Hillburn, N. Y.—Model of the Ramapo automatic safety switch and switch stand.

Ruffner & Son, Philadelphia, Pa.—Samples of Excelsior nut locks.

Weber Railway Joint Mfg. Co., New York.—Full size models of three styles of Weber joints.

The entertainment feature of the convention included carriage and car rides to points of interest in Washington and a trip down the Potomac River. To-day (Friday) the members and guests will visit Fredericksburg and Richmond.

## Automatic Block Signaling on the Boston Elevated.

Readers of the *Railroad Gazette* are already well acquainted with the general features of the Boston Elevated Railroad, from numerous illustrated descriptions which we have given; and the signaling has been briefly described in connection with the diagrams which were published April 19, page 269, and June 28, page 462.

Additional details of the signaling are given in a bulletin which the makers, the Union Switch & Signal Company are now issuing; and from this bulletin we are permitted to copy the following paragraphs:

Electric railway engineers are loath to surrender any portion of their installation to block signal purposes; but rail circuits, as employed in automatic block signaling, require the exclusive use, in an electrical sense, of at least one rail of each track governed by the signals. Hence, electric railways having no other returns for their propulsion current than the running rails, would, to introduce the automatic rail circuit for signal purposes, virtually double the resistance of their power returns in surrendering the one rail of each track required for this purpose.

Such a procedure could not be countenanced under ordinary conditions, since the already high resistance of the rail returns is a potent factor in preventing high economy in power distribution on most electric railways. Furthermore, the drop along such a return system must necessarily be great where traffic is heavy, and consequently measurements from terminal to terminal of a given length of track, constituting any one of a series of block sections, show an influence resulting from this general drop where one of the rails is common to the return of the propulsion system and to the rail circuit of the block system, which is the case where such a block system is installed on an electric railway of the usual construction.

This influence in the return rail naturally varies with the volume of traffic on the line, and, at its maximum, would be fatal to the successful control of automatic signals by the rail circuit method where the block sections are required of considerable length.

Serious consequences might also result to the instruments of the block apparatus of such an equipment should imperfect contact occur between rails and car wheels. This would cause a sudden rise of E.M.F. in the block rail far above that of the block signal apparatus did the imperfect contact occur upon the *return* rail only. Ordinary instruments would be destroyed or badly damaged by the abnormal current thus forced through them, and a false signal indication might also be displayed at the entrance of a block so affected.

Altogether, the problem was not attractive originally, and, as applied to usual conditions, still remains so. Conditions presented themselves on the Boston Elevated lines, however, which greatly relieved the situation as usually presented, and encouraged an attempt to install on that road what has since proved to be the first and only automatic block signal system for *electric* lines that insures absolute and continuous control of the block signal by all pairs or any pair of wheels of a train within the block it governs.

Owing to the great capacity of the elevated structure as a return conductor one rail of each track was freely surrendered to block purposes, and at a relatively small loss in the electric efficiency of the power system. Owing to this great capacity, also, the drop influence within the block section became less serious in its effect upon the block apparatus. The frequent service of the elevated system made short block sections imperative, producing another favorable condition by thus reducing the drop influence.

The remaining problem, that of preventing the dangerous operation of the block signal, or the destruction of its controlling mechanism, either of which seemed reasonably certain to occur in the event of the propulsion current finding a return through the block rail and instruments, was next solved most effectively.

First, the block instruments were made of an electrical capacity equal to the emergency of meeting the full E.M.F. of the propulsion system at their terminals without injury. Second, these devices were *polarized*, so as to respond only to currents of a fixed direction. These currents are *counter* to those that might, in the emergency referred to, flow through the instruments from the propulsion system, and the latter could therefore cause no serious operation of the signals.

One of the most valuable features of the Westinghouse electro-pneumatic system is the ease and simplicity with which the signals are controlled automatically by trains. It may seem inconsistent to use compressed air on a railroad where electric power is at hand throughout the length of the line; but this use is not surprising to those who know how promptly and satisfactorily enormous energies can be controlled by the simple valves of the Westinghouse system; nor to those who realize how much more readily and safely the small electric energy required for the valve magnets of air cylinders can be controlled than can the vastly greater energy that would be consumed by electric motors, were these applied to the work of the cylinders.

With the electro-pneumatic block signal, owing to the extremely small volume (.025 ampere) and low E.M.F. (10 volts) of the current employed to operate it, no serious sparking or burning of relay contacts occurs, whereas, with an electrical device of similar character these could not be avoided and frequent attention to and renewal of contacts would become necessary. On the Boston Elevated each automatic signal is equipped with an attachment for setting the air-brakes of trains should they attempt to pass the signal while in the danger position. This attachment imposes some extra service on the signal-operating power. This additional duty, with the normal friction of the parts and the abnormal friction due to snow, sleet and ice demands that the signal be well counterweighted toward the danger position, and hence an operating device that is capable of overcoming this weight. The electro-pneumatic semaphore signal, of which thousands are in use throughout the country, employs a cylinder 3 in. in diam., having a piston stroke of 4 in. The air pressure employed ranges from 60 to 80 lbs. per sq. in., according to conditions, the average being 70 lbs. The cylinder develops an energy per stroke of (70 x 7 x ⅓) 163.3 foot pounds. While this energy may be in excess of that required under the most adverse ordinary conditions (which it was designed to meet) the unusual conditions on the Boston Elevated lines render it very desirable. Here the signal cylinder must meet the additional load represented by the rotation of the train stop shaft, which is augmented by the fact that the counterweight of the signal must be ample to overcome the additional influence of a severe winter upon the shafts, bearings and connections. The movement of an electro-pneumatic signal from danger to safety is accomplished in two seconds, representing approximately $^1/_7$ h.p. Electrically this is equivalent to about 106 watts, and if an electric motor were substituted for the electro-pneumatic cylinder, it must necessarily consume this energy in operating the signal in the time specified.

The contacts of track circuit relays are necessarily of a relatively delicate character, owing to the comparatively feeble energy that is, under many conditions, available for operating them, and as the pressure on these contacts varies greatly with this energy, the control of a 106-watt circuit by them is not practicable without an unwarranted amount of attention and renewals thereto. The difference between 106 watts and ¼ of a watt is, therefore, the difference between the *electrical* energy required by a purely electric signal, equal in capacity to the electro-pneumatic signal, and the electrical energy employed by the latter. The advantage this difference gives to the electro-pneumatic signal on the elevated lines can scarcely be overestimated.

Upon the elevated structure during very dry weather, and in the subway where similar conditions exist at all times, the resistance between the block rail and that one common to the block and propulsion systems, is much greater than the resistance existing between these rails on the structure during wet weather. This is a natural feature that belongs to track circuits in general. Owing to this variable resistance, which constitutes a shunt upon the relay of the block section, the source of electrical energy provided for the operation of track circuits must vary in output with the weather conditions. It is also essential that some resistance exist within the generator, or be inserted between it and the block rail, in order that when the relay is completely shunted by the wheels and axles of a train the generator will not force an excessive current through the short circuit thus formed, and incur an extravagant waste of energy at a time when no energy is required in the block affected.

While some waste of energy is at such times unavoidable, the limit of economy in each section is determined by the minimum resistance existing between the rails at any time when the block is unoccupied. This resistance in long sections has, in a few instances, been found to be as low as 3 ohms. Sections upon which measurements were made to determine this fact showed later a resistance of 20 ohms, under a dryer condition of the ties.

It is usually the custom to employ ordinary gravity batteries for supplying current to track circuits, first, on account of their simplicity and cheapness, and second, because they have within themselves the necessary resistance for holding in check the excessive waste of current which would otherwise result when they were short-circuited by trains or from other causes. To substitute for gravity batteries in this service any type of battery or other generator whose internal resistance is negligibly low, would, to obtain equal results, necessitate the interposition of a resistance between them and the rails, equal to the internal resistance of the gravity type.

When two or more track circuits are to be operated by a common generator, this resistance, instead of being common to all, must be inserted as separate units in each circuit so operated, otherwise a change occurring in the conditions of any one circuit would cause a variation or failure in all others, which, is, naturally, as undesirable in track circuit work as it would be in electric lighting, where a resistance common to all lamps on a multiple light system would cause the illuminating power of those burning to vary whenever a change in their number occurred.

In a number of installations made by this company in years past track circuits have operated in multiple from a single generator with eminent success. A comparatively recent installation of electro-pneumatic signals on the four tracks of the Philadelphia Division of the Pennsylvania Railroad is a most notable example of this method. There a single cell of storage battery, located in the base of each four-arm bracket signal, not only supplies current for operating the air valves of the four signals, but also for the two adjacent track circuits terminating thereat. All of these batteries are charged in series from a common 500-volt generator through a No. 6 copper line 20 miles long.

Prior to the completion of the block signals on the Boston Elevated the use of dynamos for the direct operation of all track circuits and all signals had not been undertaken. As a rule, signal experts on steam railroads do not favor a signal system which depends upon the continuous motion of a generator for its operation, and to introduce storage batteries for the purpose of avoiding total derangement should the generator become disabled, while eliminating its worst feature, adds materially to its cost.

On the Boston Elevated, however, as on most electrically operated roads, the fact that the signals depend

DIAGRAM ILLUSTRATING EXTREME CONDITIONS NECESSARY TO PRODUCE FAILURE OF TRACK RELAYS OF THE BOSTON ELEVATED AUTOMATIC BLOCK SYSTEM.

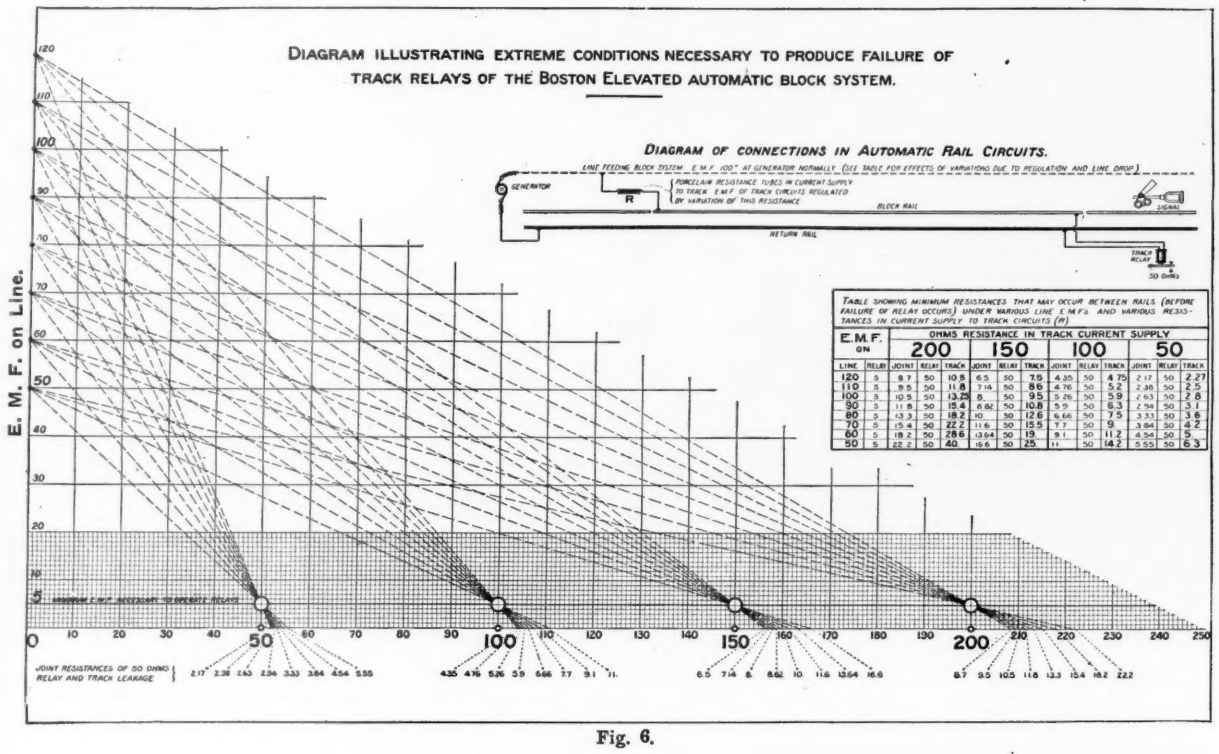


TABLE SHOWING MINIMUM RESISTANCES THAT MAY OCCUR BETWEEN RAILS (BEFORE FAILURE OF RELAY OCCURS) UNDER VARIOUS LINE E.M.F.'S AND VARIOUS RESISTANCES IN CURRENT SUPPLY TO TRACK CIRCUITS (R).

| E.M.F. ON | OHMS RESISTANCE IN TRACK CURRENT SUPPLY | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 200 | | | 150 | | | 100 | | | 50 | | |
| LINE | RELAY | JOINT | RELAY | TRACK | JOINT | RELAY | TRACK | JOINT | RELAY | TRACK | JOINT | RELAY | TRACK |
| 120 | 5 | 8.7 | 50 | 10.8 | 6.5 | 50 | 7.6 | 4.35 | 50 | 4.75 | 2.17 | 50 | 2.27 |
| 110 | 5 | 9.5 | 50 | 11.8 | 7.14 | 50 | 8.6 | 4.76 | 50 | 5.2 | 2.36 | 50 | 2.5 |
| 100 | 5 | 10.5 | 50 | 13.25 | 8. | 50 | 9.5 | 5.26 | 50 | 5.9 | 2.63 | 50 | 2.8 |
| 90 | 5 | 11.8 | 50 | 15.4 | 8.82 | 50 | 10.8 | 5.9 | 50 | 6.3 | 2.94 | 50 | 3.1 |
| 80 | 5 | 13.3 | 50 | 18.2 | 10. | 50 | 12.6 | 6.66 | 50 | 7.5 | 3.33 | 50 | 3.6 |
| 70 | 5 | 15.4 | 50 | 22.2 | 11.6 | 50 | 15.5 | 7.7 | 50 | 9. | 3.84 | 50 | 4.2 |
| 60 | 5 | 18.2 | 50 | 28.6 | 13.64 | 50 | 19. | 9.1 | 50 | 11.2 | 4.54 | 50 | 5. |
| 50 | 5 | 22.2 | 50 | 40. | 16.6 | 50 | 25. | 11. | 50 | 14.2 | 5.55 | 50 | 6.3 |

Fig. 6.

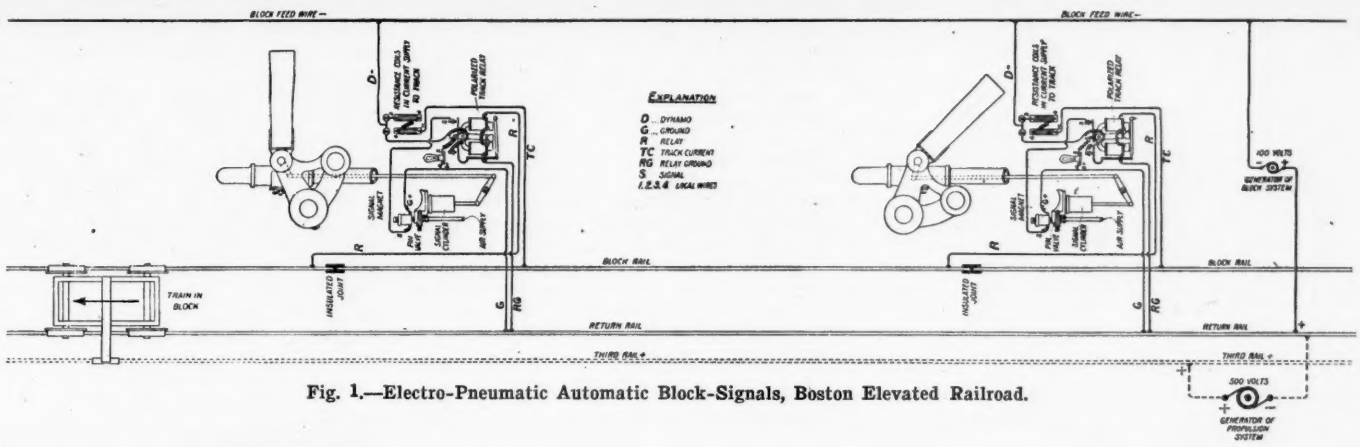


Fig. 1.—Electro-Pneumatic Automatic Block-Signals, Boston Elevated Railroad.

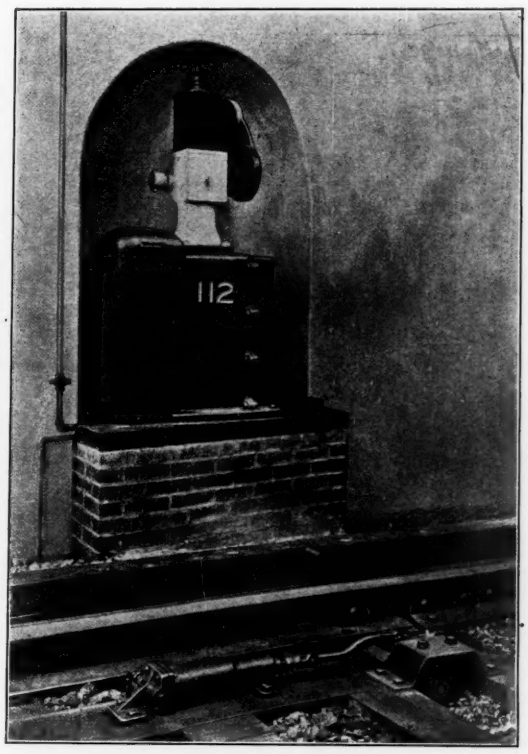


Fig. 2.—Electro-Pneumatic Block Signal in Boston Subway, With Automatic Train-Stop Attachment.

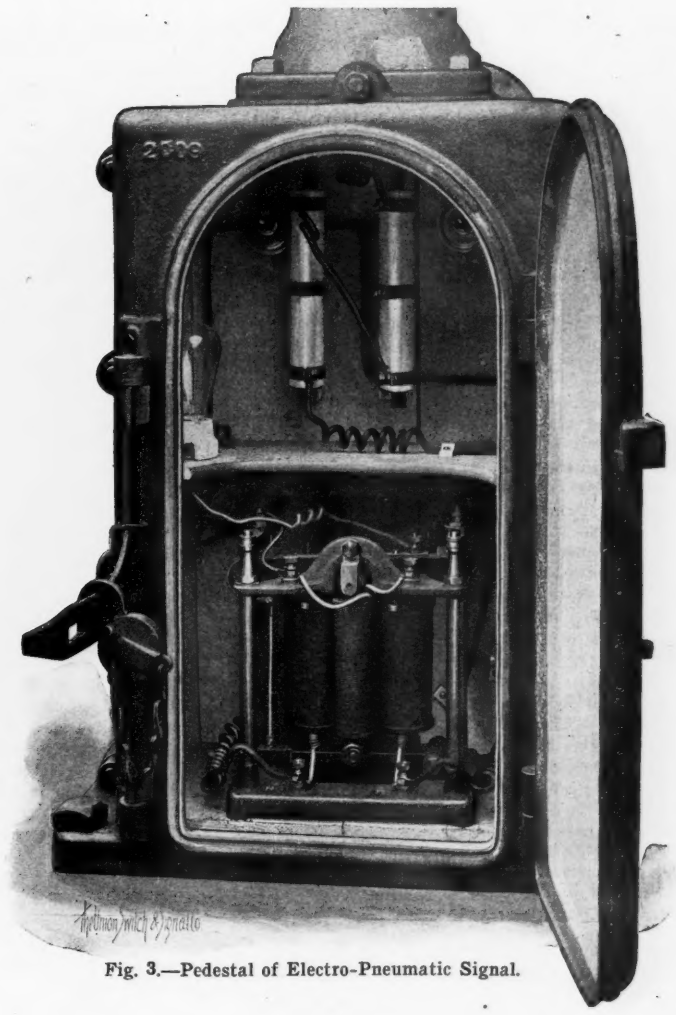

Fig. 3.—Pedestal of Electro-Pneumatic Signal.

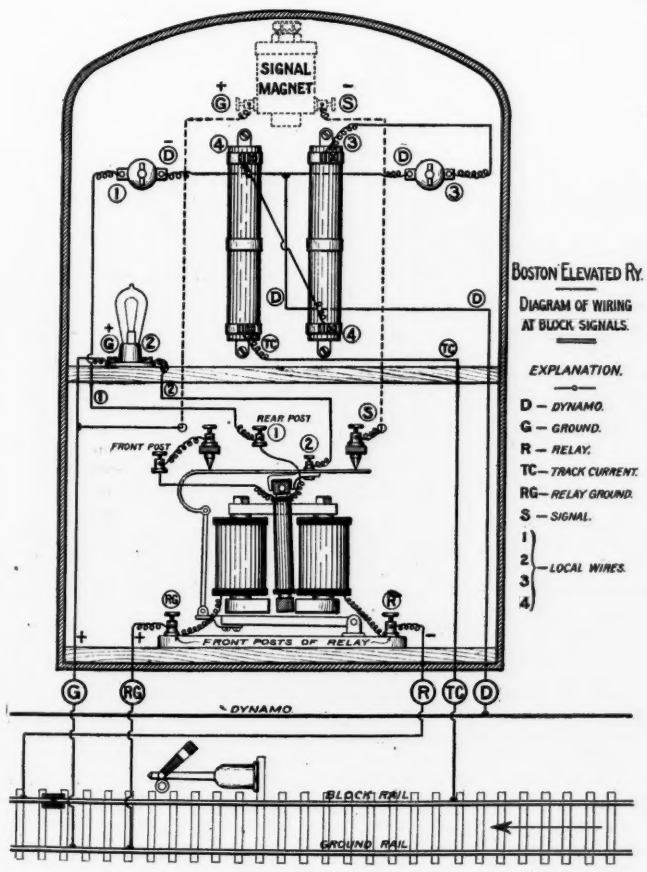


Fig. 5.

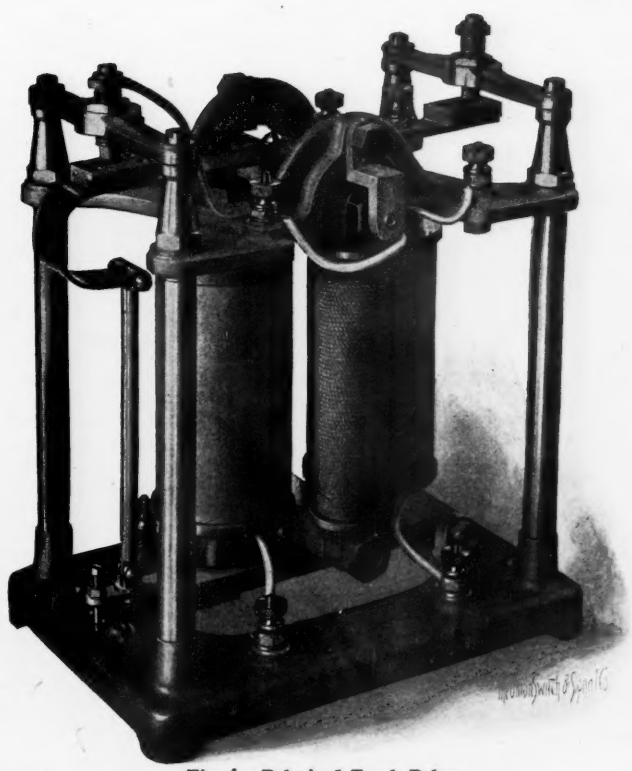

Fig. 4.—Polarized Track Relay.

on the continuous action of electric generators is not a serious matter, because these are here operated directly from the main feed wires of the propulsion system, and any interruption of the energy in these mains would not only derange the signal system, but would stop the cars as well.

Ordinarily, relays of track circuits are made to respond to currents of extremely low potential, and are for this reason of low resistance and of diminutive proportions. A resistance of 5 ohms is common practice, though this is decreased to 2 ohms and increased to 12 ohms where extreme conditions occur. A potential difference of ¼ volt at the magnet terminals of these relays will ordinarily operate them, and rare indeed are the conditions which permit of one volt being maintained thereat where usual practices are followed.

The drop influence in the return rail of the Boston Elevated, previously referred to, prohibited completely the use of relays so responsive to low E.M.F. at their terminals, and compelled the use of a type that could not be operated by any potential difference that might be created at its terminals from this influence.

After a series of tests conducted during the erection of the signals, and while practice trains were being run for the instruction of trainmen it was decided that any relay responding to an E.M.F. of 2.5 volts at its terminals was unsafe for all conditions. To provide for future increase in the volume of traffic, which would naturally develop a somewhat higher E.M.F. at relay terminals, and to give a wide factor of safety generally, all relays were constructed so as not to respond to any E.M.F. under 5 volts. This construction included the winding of the magnets to a resistance of 50 ohms.

To maintain a minimum E.M.F. of 5 volts at the terminals of such a resistance, when shunted by the maximum leakage encountered between rails, without the use of very expensive mains, was impracticable over so extensive a system, unless the E.M.F. of the generator was made higher than that required at the relay terminals. For this reason a comparatively high voltage machine was determined upon, and the E.M.F. maintained in the two No. 6 copper lines constituting the feeders of the block system is ordinarily 90 volts, though in fair weather this may, if desired, be lowered to 60 volts without trouble ensuing.

The joint resistance of a 50-ohm relay and the resistance of a 3-ohm shunt thereon (which, during wet weather, is the minimum formed by the conductivity of ties within the block controlling the relay,) is practically 2.6 ohms. To secure at the terminals of this resistance (the rails of the block section) an E.M.F. of 5 volts by means of a 90-volt generator requires a resistance approximating 50 ohms between them. The maximum current delivered through this resistance is 1.8 amperes, hence, at 90 volts, each track circuit so equipped consumes an energy of 162 watts as a maximum. This, however, is vastly in excess of that required by the majority of the sections, most of which are so short as to permit of 150 ohms being used in their current supply.

For comparison's sake it will be interesting to note the influence that would accompany the substitution of a 15-volt generator for the 90-volt one used. The resistance that would then have to be interposed between the generator and the block rail would, to maintain a 5-volt potential at relay terminals under the conditions stated, be but 7.8 ohms. Through this, slightly over 1.9 amperes would flow during the presence of trains upon the section, while the energy consumed would represent practically but 30 watts—less than one-fifth that consumed under the 90-volt system.

To maintain an E.M.F. of 15 volts in a line of the length needed and carrying the current required, would have necessitated either a vast increase in its size or else a greater number of generators at intermediate points along it than the number now in use, and this would have involved an outlay in money not warranted by the saving to be thus effected in the relatively small power consumed for block purposes. It is very apparent, however, that where separate generators are located at the end of each track circuit for supplying them individually with current, economy demands a very low E.M.F. in them; and it is partly in recognition of this fact that two cells of gravity battery constitute such generators in steam line practice.

At each terminal and at each of the two intermediate junctions of the Elevated road a motor generator is located, from which the electrical energy for the block system is derived. These machines have a capacity of 50 amperes at 110 volts (5.5 K.W) and any two of them operated in parallel suffice for the energy required. Normally these deliver 40 amperes at 90 volts each, the total electrical energy generated being 7.2 K.W, hence, about 12 electrical h.p. is drawn from the main of the propulsion system—an amount insignificant in its relation to the total from which it is derived, and one producing possibly greater indirect benefits to the railroad company than any equal amount employed elsewhere in the service.

This power is applied to the operation of 175 signals, 61 switches and about 50 indicators of various types and for various purposes. To this, for the total electrical energy consumed for safety appliances, should be added about 40 h.p. that is also drawn from the power mains for working air compressors.

Two Ingersoll-Sergeant, duplex, class J compressors are located at each terminal, geared direct to a 40-h.p. Westinghouse 4-pole, 500-volt D.C. motor, operated from the power mains. Any one of these machines is more than capable of maintaining the air supply, and each is provided with the automatic unloading device which permits the motor to run continuously, yet economically, when compression ceases. The duplication of these machines at each terminal was to avoid possible interruption to service in the event of one machine becoming disabled at a time when the pipe line under the Charles River might be damaged by dragging anchors or otherwise.

The negative pole of the generators which develop the energy employed for propulsion purposes is that one which connects with the ground and general return system, the positive pole being connected with the third rail.

To secure the benefits for which the relays of block sections were polarized it was naturally proper to ground the positive pole of the block generators, and to connect the block feed wire to the negative pole of that generator, as shown diagrammatically in Fig. 1. By this arrangement should sand or ice on the rail, or other cause, produce imperfect wheel contact with the ground rail, the propulsion current thus caused to be sent through the track relay would operate its polarized parts to hold open the signal circuit, and thus hold the signal at danger. With a relay not polarized such a current would close it, and thus clear the signal.

The construction of this relay is deserving of attention, being quite a departure from ordinary methods in signal work. Fig. 3 gives a clear idea of it mounted in the pedestal of the signal with the resistance coils, which are inserted in a branch from the block feed wire to the rail of the track circuit as before stated. At this side of these coils are two rotary cut-out switches, by which the current may be interrupted in both the signal and the track circuits during inspection and tests. At the left is a 32-C.P. lamp which is employed as a resistance only in the circuits controlling the signal. On the back side of the pedestal is located the electro-pneumatic valve and cylinder for working the signal.

Fig. 4 illustrates the polarized relay alone. Pivoted to the base is an armature having at its outer end a suitable adjustment for limiting its motion, and a link extending upwards into connection with a contact lever carrying two carbon plates at its outer ends, which lie under contacts of the same substance mounted in insulated brackets secured to the top plate. This armature is raised by the pair of large magnets when these are energized, and irrespective of the direction of the current flowing through them. When elevated, the armature closes that contact carried by the end of the contact plate to which it connects. This plate is secured to the upper pole piece of a pair of smaller magnets mounted transversely to those first mentioned, and suspended in the top plate by trunnions formed upon the ends of the pole piece referred to. The lower ends of these swinging magnets are joined together by a bar forming the lower pole piece, which lies betweeen the extended ends of the cores of the larger fixed magnet, and is attracted by one or the other of these according to their respective magnetic conditions. The swinging magnets are wound to produce like poles always at like terminals of their cores, and hence, the two-pole pieces joining them constitute the actual poles of the magnets. The fixed magnets are wound in the usual manner, and are included in the track circuit, where they are ordinarily influenced by a current of one direction when the block is unoccupied—this current coming from the generator of the block system. When a train occupies the block, these are de-energized as in ordinary track relays. When influenced by abnormal currents—those from the propulsion system—they are also energized, but their poles are then reversed.

It is to prevent the clearing of a signal falsely, by the closing of the contact first mentioned, under the last stated condition, that a second contact is introduced in the signal circuit. This second contact is operated by motion of the swinging magnets, which accomplish this by virtue of their constant polarity, and the reversal of the polarity of the fixed magnets when these are energized by abnormal currents. The closing of the first-mentioned contact tends to open the other one, and to move the lower pole of the swinging magnets toward the pole of the left hand fixed magnet.

The instant the first mentioned contact is closed a current is sent through the coils of the swinging magnets and a lamp resistance is placed in series therewith. This current, energizing these magnets, causes their lower pole pieces to move to the opposite pole of the fixed magnet from that to which they were mechanically forced during the closure of the first contact, and thus closes the second contact in the signal circuit; and not until this is done will the signal be cleared. The mechanical effect of this electrical shifting of the swinging magnets tends to open the contact first closed by the fixed magnet, but the energy developed is not sufficient to be effective in doing this. In this feature of the relay lies one of its valuable characteristics. Ordinarily the current required to operate a relay armature must be reduced about 50 per cent. before the armature will be released. In this relay, owing to the mechanical counter effect of the swinging magnets upon the work performed by the fixed magnet, the armature of the latter drops in response to the slightest reduction of the current below that required to lift it.

This feature renders the relay extremely responsive to the shunting influence of trains within the block section, and eliminates almost completely the wide range of difference found in ordinary relays between the amount of energy required to lift the armature and that to which it must be reduced before the armature is released, this latter in many cases being fully 50 per cent. of the former. The ideal track relay should release its armature on a 1 per cent. reduction of current below that required to lift it. The relay just described closely approaches these conditions by reason of the characteristics mentioned.

The electrical connections peculiar to the terminal of each block section are shown diagrammatically in Fig. 5. The branch D from the main feed wire connects directly to the cut-out switches 1 and 3. The right hand switch controls the current supply to the track circuit, which flows by wire 3 through the two resistance coils and wire T. C. to the block rail. These coils have 100 ohms in each, but only on the shortest block sections is the full resistance permissible.

The left hand switch controls the current to the signal mechanism, which flows normally by wire 1 to the swinging magnets of the relay; from thence it passes to the front contact of the relay, through the contact bar to posts 2 and S, where it divides and flows from 2 to a 16-C.P. lamp and thence to the common return. From S it passes directly to the magnet of the signal air-valve, and from that to the return.

A train short-circuiting the relay causes the front contact to open, thus cutting all current from the signal and lamp and permitting the signal to move by gravity to danger. If, however, the relay should be excited by current from the propulsion system, under this condition, the closure of the front contact would not be followed by a similar condition of the rear one (S) because of the polarized feature of the device. The lamp only, under these conditions, remains in circuit with the swinging magnets.

Under normal conditions the signal circuit forms a shunt on the lamp, the coils of the swinging magnets forming a resistance common to both. By this arrangement any interruption to the current through the swinging magnets must also interrupt that holding the signal at safety, and thus cause the latter to move to danger.

It is, therefore, evident that the device cannot be depolarized without producing a danger signal, a principle of great value in automatic block signaling.

Fig. 6 shows diagrammatically the controlling elements of a track section as used on the elevated road. It also illustrates a graphic method of ascertaining the minimum resistances that may occur between the rails of a block section under various conditions before a failure of the relay therefrom will result.

The horizontal lines represent various E.M.Fs. of the feed wire, while the vertical lines are ohm divisions. The numbers 50, 100, 150 and 200 represent the several units into which the resistance coils in the current supply to various track circuits are divided, as conditions require them.

For instance, if track conditions require the use of a 50-ohm coil in the current supply, the line 50 would mark on the diagram the terminal of such a coil. If 100 ohms are required, the line 100 indicates its terminal, etc. Having 80 volts on the line, and securing a reading of 10 volts at the terminal of a track relay, one may draw a line diagonally from 80 on the vertical marginal line to 10 on that one of the vertical lines which marks the terminal of the resistance within the coil used on the section so measured. Where the diagonal line intersects the horizontal base line may be read the resistance existing between the coil and the return rail, i.e., the joint resistance of the 50-ohm relay and the resistance between rails. This joint resistance will be represented by the base line of the triangle thus formed to the right of the line marking the terminal of the coil. Knowing the resistance of one member of the joint resistance (the relay) the other may be readily calculated. This resistance determined, it may be compared with that given in the table under the number corresponding to the coil resistance which is used in that particular circuit and opposite the number corresponding with the E.M.F. of the line at the time of measurement, to determine whether or not a sufficient margin exists for reliable operation under extreme conditions.

The figures given in the table are derived from projections on the diagram through the 5-volt line at the terminal of each unit of resistance, and represent the minimum resistances possible between the rails, under the conditions indicated, before relay failures will occur as at present adjusted.

The signals are worked upon the normally clear principle, and so frequent are the trains that each is operated fully 660 times daily. There is probably not a better example in existence of the value of automatic signaling in expediting train movements than this one presented on the Boston Elevated lines; and nowhere else can the wisdom of operating automatic signals on the normally clear principle be so fully demonstrated as here, where, were the normally danger method employed, frequency of train movements would virtually convert it into a normally clear one.

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The long-planned limited train between Berlin and Naples will run three times a week the coming winter. Going south it will leave Berlin at 9:45 p.m., reach Bologne at 8:20 the next morning, Florence at noon, Rome at 5:37 p.m., and Naples at 11:30 p.m. In the other direction it will leave Naples at 8:05 a.m., and reach Berlin at 9 a.m., the next day. As with other limited trains only first-class cars are in the train, with dining and sleeping cars.

## Roadmasters' Association—Abstracts of Reports.

The annual meeting of the Roadmasters' and Maintenance of Way Association was held in Washington this week, beginning on the 8th. On another page we publish a current report of the proceedings, and give below abstracts of such papers and reports as have reached us.

### USE OF FORTY-FIVE-FOOT RAILS.

For several years past, one of the principal topics of discussion at the various maintenance of way meetings has been the use of rails over 30 ft. long. . . .

In regard to the 60-ft. length, the opinion is apparently divided. The personal experience of the writer has been that a shorter length is more economical to maintain and more economical in first cost.

Thirty-three feet has been recommended by this Association, and also the American Railway Engineering and Maintenance of Way Association, as a standard. This is a decrease of 10 per cent. in the number of joints used. . . .

Before going any further into the subject, your attention is called to a few facts from the manufacturer's standpoint, as given by Mr. Carhart, of the Illinois Steel Company, at the Detroit meeting of this Association as follows:

"Whereas, one man will straighten a 30-ft. or a 33-ft. rail, when you come to handle a 60-ft. rail it takes about four men to handle it, and it is a very difficult matter, after a rail has been straightened, to say whether it is straight or not. . . . As to the cost, you can judge for yourselves, where you nearly double the force. . . . I would not want to say, with my 15 years' experience in the mill, that I could tell when a 60-ft. rail was absolutely straight, simply because it may be due to the way it rests on its bearings, and the movement of the hand will throw it out. . . . You can injure your steel more under the press by excessive work than in any other method. Every blow there carries your metal beyond its elastic limit and puts in a permanent set. Consequently the best rail you can get is a rail that has the least number of blows, and the only rail that we can give you to-day with modern appliances, would be from 30 to 33 ft. rail. That would give you a very few number of blows, whereas your 60-ft. rail will require from three to four times the number of blows that your 30-ft. rail will have, and in the end it will not be anywhere near as straight as the 30-ft. rail. . . . Your American section is designed for two purposes: One is to have it well balanced and cool even on your hot bed; the other, incidentally, is that you get very few blows in your straightening press and that is the only section I know of to-day that can be straightened with so little work. . . ."

It is claimed by adherents of long rails that we must look at the amount of money saved in the joints. On the other hand, we must take into consideration the amount of money spent in maintaining these long rails. Cost of lining is higher the longer the steel. This is explained by the fact that long rails are kinked unless handled very carefully. Also, unless particular attention is paid to anchoring and spacing ties, and expansion, long steel will kick out under extreme heat. The same can be said of cost of surfacing. On some gravel track the writer's attention has been called to long rail which has not been properly anchored, working at the joints, owing to being very tight. In fact, there would be so much spring, owing to the length of the rail, that it would lift up at the joints, allowing sand to run under the ties at that point, thus rendering this portion of the track high and out of surface. . . .

Unless the utmost care is taken, the expansion will run in bunches. In other words, at some points we will have extreme wide joints, and at others the rail will be tight. At the wide joints the rails will become battered and have to be replaced in time. In order to prevent this, the greatest care should be exercised in laying long steel. On all grades the same should be made tight, as well as on all approaches to stations. In sags, it should be left wide open, the same in front of stations. On level track judgment has to be used in regard to the condition of the grade each side of the level stretch.

Cost of maintaining joints is considerably increased where long rails are used. In extreme cold weather bolts are frequently broken owing to the expansion which has to be permitted. In addition to this, referring to the previous paragraph, it will be noticed that the expansion, unless great care is used, will be bunched in some places. This will give wide joints, while the rails are being battered, the joints are being pounded out of shape and additional money is expended in order to keep them up. Owing to rail being tight the joints frequently get out of line.

Taking into consideration what has previously been said regarding the use of rails over 30 ft. long, we are brought face to face with the fact, that the rail itself, if longer than 33 ft., costs more per ton, costs more to handle, costs more to maintain for the same number of tons and is more expensive to line and surface. These deductions have been arrived at by the writer from experience with 100 miles of 60-ft. rails. The nearer we approach the 30-ft. lengths these conditions are minimized, with the exception of the original cost, which the mills up to the present time have not reduced.

In the 45-ft. rails, 50 per cent. more expansion should be used than in the 30. We would recommend ⅜ in. extreme. The number of joints are reduced 33 per cent. over the thirties. Then we have the anchorage, which will cost practically the same as the joint fastenings, which have been saved.

Considering the entire question, we are of the opinion that the riding of the track where the rail is properly laid, careful attention having been given to handling the same, extreme caution having been exercised, and the expansion properly attended to, that track with 45-ft. rails will ride better than with 30-ft. lengths.

Now the question is, does the cost of maintaining the 45-ft. rails amount to less per mile than the cost of 30-ft. rails? If so, to what extent? This is where the saving (if there is any) will be effected. The cost of lining and the cost of surfacing the 45-ft. rails is slightly in excess of the 30-ft. lengths. But there is a slight saving in maintenance, owing to a less number of joints than with the shorter lengths, although the cost per joint is slightly higher.

The writer has always been an advocate of this length of rail, and when the manufacturers will turn it out for the same cost per ton as 30 or 33-ft. lengths, it is his opinion that it will be adopted as a standard on American roads.

F. R. COATES,
*Chief Engineer Chicago Great Western.*

### TIE PLATES.

. . . On the road with which I am connected, the Denver & Rio Grande, I have four kinds of tie plates in use, viz., the Servis, Walhoupter, Q. & W., and the Glendon flange. The Glendon flange is now giving the best satisfaction, as it is the strongest plate and is better adapted for our red spruce and yellow pine ties, on account of its having two deep outer flanges that fasten to and unite with the tie, and will remain so until the tie timber decays. As our ties in this country decay from the bottom, and in many instances the top is sound until the tie has decayed from below to within 2 or 3 in. of the top, the tie plate holds good the life of the tie.

On our mountain roads with heavy grades, sharp curves and heavy competition, where trains run at a high rate of speed, the tie plate is indispensable, especially on our curves with soft wood ties. The tie plate preserves the alignment and gage. There are no ties to adze, or rail to level when canted, and we do not have to regage track every few months, where tie plates are used, as is the case where rail braces are used.

On the Denver & Rio Grande tie plates are used on all curves 3 deg. and upward. We have curves up to 16 deg. on our main line. . . .

In my estimation it would be economy to use tie plates in all yards on switching leads or drill tracks, as the plates would preserve the life of ties at least 50 per cent., to say nothing of the labor saved in repairs. No tie plates should be less than ¼ in. in thickness.

J. C. HECHLER,
*General Roadmaster, Denver & Rio Grande.*

### BROKEN OR SQUARE JOINTS.

. . . On double tracks, or where the traffic is all in one direction, we think the rail laid broken joints has advantages over square joints in many ways. The tendency of rails to creep, where traffic is in one direction, is very great and as a general rule one rail will creep more than another. If laid broken joints this does not make very much difference, but if laid square joints it makes considerable trouble and expense, as it is necessary to have the joints square, or very nearly square, so that the joint ties will lie at right angles to the rails, and at the same time be placed properly under the joints. This is necessary to permit the proper spiking in the slot of angle bars. If one rail creeps more than another, which is true in many instances, then the rail must be driven back in order to have a square joint. This is not necessary where rail is laid broken joints, as the joint will be in all cases nearly opposite the center of the solid rail and it is not necessary for it to be exactly opposite; therefore, it does not require any expense to drive it back.

On curves it is absolutely impossible to make perfectly square joints unless a large number of rails should be cut off enough to allow for the difference in length of the outer and inner rails on the curve. Practically this is impossible, and if joints are not kept nearly square then the joint ties can not be laid at right angles to the track. In the case of broken joints the laying of rail around a curve is very simple. New rails are usually 30 ft. long, although we get some shorter length rails cut on even feet. When laying on curves with broken joints, when the inside rail is 6 in. ahead of its proper position, we can use a rail 1 ft. shorter, which then makes the joint 6 in. back of its true position. . . .

At present on all our tracks where the traffic is in one direction we use an anchor splice on the solid rail opposite each joint. This anchor splice is a section of our angle bar and is 5 in. long with holes drilled through it the same as on the angle bar. . . .

On broken joints we do not think the tendency is as great to have low joints for the reason that the blow from passing wheels only act on one rail while the opposite side is a solid rail, and in this case the joint ties receive only one-half the force that they get in case of square joints. . . .

We also believe it is much easier to line track with broken joints than with square ones, as we have a solid rail on one side all the time. This is especially true on curves, as every maintenance of way man knows. We have all had the trouble known as joints "sticking out" where track was laid square joints, while with broken joints this trouble does not occur. It may be claimed that where joints are low it is easier to get out of line where laid broken joints. If joints are allowed to get very low this may possibly be true, but I do not think there is nearly so much chance for low joints as where rail is laid square. Admitting this to be true, it is much easier and requires less labor to line it than with square joints, for the simple reason that the angle bars are bent a little and it is easier to straighten one pair with a solid rail on the opposite side which will spring back to a straight line, than to straighten two pairs of angle bars. . . .

We are also of the opinion that the cost of laying rails broken joints is less than with square joints. It is not absolutely necessary that the rails should be laid perfectly true in regard to having one joint exactly opposite the center of the opposite rail. In such a case you do not lose any time in squaring up joints. . . .

On single track where the traffic is about equally divided in each direction, and an insufficient number of men are allowed, it may be a question which is the better way to lay rail, although in all cases I prefer the broken joints, as I believe the track can be kept in better shape, even with an insufficient number of men. The same reasons will apply on a double track railroad.

It may be claimed that on broken joints where they are low that the side or rolling motion of a train is more injurious or disagreeable than on square joints. We do not believe this is true, as a rolling motion is less injurious to the machinery and cars than a solid blow, such as occurs on low joints where the rail is laid with square joints.

For the past 10 years we have had rail laid both ways on our double tracks, and we find that where we have broken joints we have a better track at all times. We also find it true that it is easier and less expensive to keep the track laid broken joints in good shape than the square joints. From the experience we have had for the past 10 years we are very much in favor of rail laid broken joints. We believe from our experience that we can make our rail wear longer and keep it in better shape at less expense than we can with rail laid square. Under such conditions we are continuing the practice . . .

F. J. ALLEN, *Roadmaster C., B. & Q.*

For 33 years, and more, I have handled square joints, and for the past six years have handled both broken and square joints, and am decidedly in favor of broken joints, for the following reason:

The broken joints are a great advantage in laying rail, either on old or new track, as it is not necessary to be particular to the inch, as it is in laying square joints. This saves time and money. I also find track easier held in line and surface, especially on ballasted track.

I find the broken joint a great advantage on single as well as double track, more especially on double track, account of the steel creeping. . . . Where we have square joints we are compelled to drive our steel back and forth to keep the joints square. . . . I have 61-lb. rail laid in 1887, that has crept until the joints are out of square from 10 to 14 in. This steel will have to be driven back and joints squared up as soon as cool weather comes again.

Broken jointed track will not ride as well as square jointed when joints are very low, but I think this to be greatly in favor of the broken, for this being the case the surface of our track will never be allowed to run in as bad shape as it sometimes is where we have square joints. . . .

L. BRADLEY, *Roadmaster, A., T. & S. F.*

### BURNED CLAY BALLAST.

In detail the cost per yard of ballast on cars is:

| | |
|---|---|
| Land, interest on track material, track labor and stripping | $ .04 |
| Coal | .13½ |
| Burning | .17½ |
| Loading (by hand) | .07 |
| Total, per cubic yard | $ .42 |

Cost of ballast depends largely upon cost of coal. In favorable season a ton of coal will burn about 4 cu. yds. ballast using our gumbo soil. The weather has a great deal to do with amount of coal used to burn a yard of ballast. During a wet, bad season a ton of coal will not burn as much ballast as during a hot, dry season. A good quality of fancy steam coal or slack and nut mixed should be used as it makes a better fire and the heavy rains do not have the effect on the fire that they would if using slack coal.

The best burnt clay ballast I ever saw was made out of gumbo soil, but clays can be used. You can burn as many yards of ballast in a day on 2,000 ft. of fire in gumbo soil as you could on a 3,000-ft. fire in our clay. The gumbo having more vegetable matter, will burn more quickly and cool off more rapidly than clay. . . .

I consider good burnt clay ballast very efficient for maintaining track and can maintain a better riding track on it cheaper than with stone ballast. Screened stone ballast is stronger than burnt clay, but the clay ballast is handled easier and quicker.

We have some track in the Medicine Creek bottoms in North Missouri that was ballasted 12 years ago; a part of it was ballasted with stone and the balance with burnt clay. We put from 8 to 10 in. of ballast under the ties in both cases. Our burnt clay track has always been in the best repair, considering amount of work done on track; conditions about the same. The life of the clay ballast seems to be about as good as the stone.

We have got the best results from burnt clay ballast by using it to cover worn out stone ballast. We put from 6 to 8 in. of clay ballast on top of the stone and it makes an ideal track. . . .

After the clay ballast has been laid under the ties

and you get a good rain on it, then there will not be any more dust than on a stone ballasted road.

Weeds can be cleaned out of clay ballast for one-quarter the cost that they can out of stone. Ties can be renewed in clay ballast for 40 per cent. less than in stone ballast.

The life of a tie in burned clay ballast is 10 per cent. longer than in stone. I account for this that the clay is porous and dries out quicker.

In laying burnt clay ballast we tamp it with shovel blades, but our section gangs, where they are picking up low joints, etc., and don't lift track over an inch, tamp with tamping picks. Some may imagine that by using picks you injure the ballast, but my experience (12 years with burnt clay ballast) has been that I could not see that it damaged the ballast any, and we can keep a better surface on track by so tamping. . . .

W. SHEA, *Roadmaster C., M. & St. P.*

TAMPING OF TIES.

. . . As a perfect track presupposes the fact that the joint must be as strong as the other portions of the rail, no harder tamping would be required at the joint than at any other point, but, as under most existing conditions the joint is only about 33 per cent. as strong as the rail, harder tamping of joint ties is necessary, the degree of which must necessarily be left to the judgment of the foreman in charge. When new ties are placed in track they should at once be tamped to as solid a bearing as the ties immediately adjoining, regardless of whether the track is to be immediately surfaced or not, in order to avoid a possible bending of rails. When the track is surfaced after new ties are put in, the new ties should receive no harder tamping than is required to make them equal to the others in the immediate vicinity. Ties should not be equally tamped for their entire length, but an equal space each side of rail must be thoroughly tamped and center of the ties may be more lightly tamped in order to avoid center-bound track.

*Gravel Ballast.*—When ballasting or raising track above 1 in. it should first be shovel tamped, including joint ties. After this has been thoroughly done, and in course of one or two days after track and gravel has been settled and packed, this track should be gone over and carefully resurfaced and all ties bar-tamped in order to secure a good and true level track. Before any bar-tamping is done in general surfacing of track, the ties should be held up to the rail and spikes firmly driven down in order that track may not be made uneven in process of tamping. When ballasting track it is, of course, understood that the material will be put under ties as fully as possible with shovels or shovel tamping as it is called, after which it must be gone over again and tamped with bars. Material can be placed much more quickly in this manner than with bars and answer for a temporary purpose only; and for a lift over 2 in. we would recommend shovel first and bar afterwards. On roads with fast and heavy traffic, shovel tamping will not hold the surface so as to be safe for fast speed, hence the bars should soon follow the shovels.

Joint ties should be tamped harder than any other ties, also all ties should be tamped the hardest outside and under the rail. In light surfacing we would recommend tamping from the center of rail towards joints as being more conducive to track remaining in good surface. When placing new ties in main track they should be shovel tamped on the day they are put in. The following day the proportion of track which is low should be raised to a true level and all ties so raised should be tamped with tamping bars or picks. Also all new ties should be retamped with tamping bars or picks, even if track does not require raising at points where they are put in. The tamping should be well done.

*Broken Stone Ballast.*—Track raised above 2 in. should first be shovel tamped, that is, the stone to be pushed under the ties with the shovels. After this has been thoroughly done tamping picks should be used in forcing or packing the stone under the ties, and in course of one or two days after the track has been raised, the track should be gone over again and carefully resurfaced and all ties pick tamped outside and under the rail; also the joint ties inside for about 18 in., the remainder of joint ties inside, as well as other ties inside, should be bar tamped. Better results are obtained in tamping ties on both sides, viz.: first dig out and lightly fill ties on side from which trains approach, then tamp the other side firmly, tamping reverse side, inside of rail, for about 15 in. In light surfacing great care should be used; raising bar needs to be used only in exceptional cases. Most of the work in taking out "nips" or low places, should be and can be done with tamping picks; too frequent use of bar is apt to loosen up track, giving a more uneven bearing than when the picks are alone used. When placing new ties in stone ballast they should all be thoroughly pick tamped the same day they are put in to avoid bending or kinking of the rail. An important feature on stone ballast track is that every tie must be solid, and in all cases where there is any doubt about joints not being thoroughly tamped in first going over they should be given a second tamping before leaving. With many it is a practice when track is raised more than an inch, to first tamp on the receiving side, on the outside of the rail, then tamp the leaving side in the same manner. On the inside they first tamp the leaving side and then the receiving side. Ballast forks are best adapted for handling stone ballast.

*Sand Ballast.*—When dry much better results can be obtained by shovel tamping than by use of the tamping bar, but when sand is wet, bars should be used, the blade or pad of which should be at least ½ in. thick. After the tie is tamped, sand should be drawn in beside the tie with the bar, so that the earth, which has been forced under the tie will not be loosened or jarred out, then in case of a sudden heavy shower the sand thus pulled in will prevent the water from softening the tie bed. Better results are obtained by tamping towards middle of the track, about 18 in. from the rail, than when the tie is tamped the whole length. In renewing ties they should be bar tamped soon after they are put in.

*Burnt Clay Ballast.*—If the track is raised above an inch the material is to be pushed under the ties with a shovel, when thoroughly done. The shovel handle should be used to pack the material as hard as possible. After the track and soil has settled, in the course of a day or so, this track should all be carefully gone over again and uneven places raised and retamped with shovel handles or thick especially constructed tamping bars for soil tamping. When placing new ties or surfacing the tamping should be done in a similar manner. . . .

R. P. COLLINS,
*Roadmaster N. Y., N. H. & H. (Chairman.)*

CHEMICAL TREATMENT AND HOLDING POWER OF THE SPIKE.

This paper refers only to the Zinc-Tannin or Wellhouse process of timber preservation. . . . The consense of opinion, supported by the tests made by your committee, is that treatment does not increase the hardness of the wood, but does increase its density and transverse crushing strength in proportion to the amount of treating material absorbed. But, while the timber is not hardened by the treatment, it is made more flexible and tough, and will, by reason of the increased density of the wood and action of the chemicals used, prevent the rail from cutting into the ties, in proportion to the amount of preservative absorbed, or about 30 per cent. in coarse grained pine. . . .

We find that the spikes, when driven, damage the fiber of the timber less in treated than in untreated timber. The holding power of the spike is not noticeably increased at the time the tie is treated, but increases as the timber dries out, until at the end of from six to nine months, when the timber has become seasoned, a pine tie which has absorbed the usual amount of chloride of zinc, tannin and glue, will have increased the holding power of the track spikes not less than 30 per cent.

J. E. M'NEIL,
*Southern California Railroad.*

## The Derail; Its Past, Present and Possible Future.

BY E. D. WILEMAN.

The introduction and first use of the derail seems to be buried in oblivion. May it not, like Topsy, have "jest growed?" The most primitive device with the elements of a derail that I have ever seen was an old tie chained to the rails of a siding to prevent side-tracked cars from fouling the main track. Those who are at all interested in the subject must be more or less familiar with all the intervening steps of the development from this crude appliance to the present practice of directly connecting a split-point in the outside rail of a siding to the stand of the main line switch. The latest attempt to perfect such a device is a law in Indiana which requires all such points to be safeguarded by a day and night signal located at and directly connected to such derail point.

There have been two comparatively recent patents on connections between the main line stand and a siding derail: One in April, 1890, showing stub rails and employing a rigid pipe or rod; the other (May, 1892) had split-points with a double wire and "T" crank. It was, of course, impossible for either of these patents to have any commercial value as all their essential features had been in use for years.

One of the prominent steps in this development has been the chock or scotch block, which has lately found and stepped aside into a sphere of its own. Several forms of it are on the market. One of the best known is the Travis, Figs. 1 and 2. The Smyth is made on the same principle, but is about 3 ft. long, guiding the wheel flange upward and outward less suddenly. Another recent one is the Anderson-Bevan, shown in Fig. 3. These forms are only intended for use in close quarters, where there is not room for a regular point; nor are they entirely reliable for heavy work, as instances are known where the leading truck of a heavy engine has passed straight over the block without the slightest deflection.

A close search of official records fails to reveal any attempt to secure a patent on the derail itself as a factor in preventing a train or engine reaching a point of greater danger, such as a grade crossing in use by another road or an open drawbridge. There are, however, several patents on different ways of connecting and operating derails at such places, and any quantity of devices for automatically stopping trains if they have not already been given the right of way; one of the most comical being a loop of rope that is held open by a steel spring and then chained or clamped to the rail, at a suitable distance, for the purpose of catching a pre-arranged lever on the engine and setting the brake.

As an integral part of an interlocking plant, derails were in use in England long before the erection, in 1875, of the first plant on this side of the pond; and it seems quite certain that their early form was a complete switch, frog and all, with the addition in many cases of a bumping post or pile of sand at the dead end to assist in making the stop. This, of course, was expensive, and frequently impossible for lack of room; hence, the necessity of economy, both as to first cost and space, has developed the single switch point, which is in common use at the present time.

The defects of this device are obvious. When closed, it may be enough out of adjustment to form a lip which a sharp flange will climb and cause a derailment; when open it may be struck with sufficient force to break it loose and throw it aside, allowing the wheels to mount

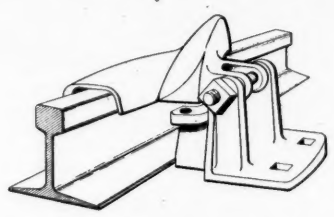


Fig. 1.—Travis Derailer.

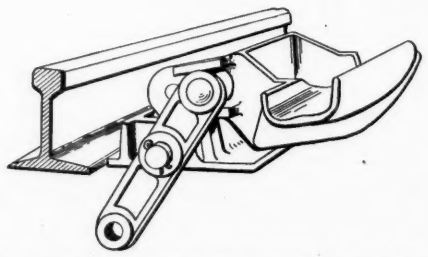


Fig. 2.—Travis Derailer; to be worked by a lever.

the main rail and go on. It forms an open expansion joint in one side of the track, inviting that rail to creep more freely than the other, and hence it is a factor in disturbing and distorting the crossing frogs where it is used. This feature has been almost entirely overcome by inserting a heavy cast throating between the main rail and the bent stock rail and bolting them rigidly together; but an extremely hot sun has been known to expand the rails so as to shear the four bolts of such a fastening. With this exception, this remedy has proved quite effective, making the cut rail as rigid as the undisturbed one on the opposite side.

The practice as to guard rails at a derail varies con-

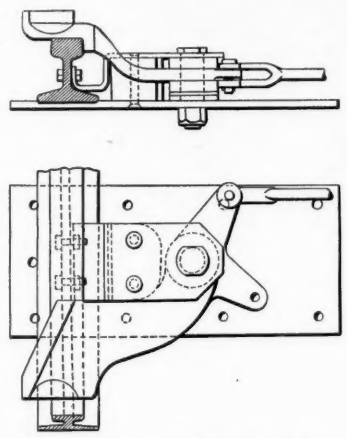


Fig. 3.—Anderson-Bevan Derailer.

siderably. Some states specify, in their regulations concerning interlockings, what the length of the guard rail shall be, the object being a measure of safety for the derailed engine. It is, however, an expedient of doubtful value, as a heavy freight train has been known to go off an open derail, that was further than the usual standard of 300 ft. from the crossing, where a guard rail for nearly half the distance kept it so true in line that the engine reached the opposing road, climbed over three tracks and finally turned over when it ran off the ends of the ties about a car length beyond the last crossing. That derail was thus made utterly worthless as a measure of protection. Of course, without any guard rail, the chances are greatly in favor of an engine going off the ends of the ties almost as soon as it leaves the heel of the stock rail; it is then almost certain to turn on its side with more or less damage to itself and danger to the lives of the crew; with the increased annoyance of blocking one or more additional tracks wherever the derailment occurs on the inside one of three or more parallel tracks.

How, when or why, 300 ft. was adopted as a standard distance for a derail from the protected danger point it is difficult to say. It may have been sufficient, when adopted, but almost every one concedes its inadequacy to meet present conditions. At least one state requires 400 ft. as a minimum and some are considering the wisdom of making it 500.

Some of those who are looked upon as doctors in the art of signaling contend that the proper method is to not use derails at all, claiming that they cause more damage than they prevent; and that properly placed signals,

with rigidly enforced discipline, should be entirely sufficient. But the fact that derails do cause damage certainly proves that the signals are over-run in spite of them; and it surely would be difficult to devise any sharper discipline than an open derail. As yet the majority maintain that a train having been given the right of way over a crossing is entitled to all the protection, physical as well as moral, that mechanical science can provide, chief of which is a well constructed and properly placed derail.

Having mentioned several of the chief faults of derails at present in general use, but still regarding them as a necessity, may we not profitably try to specify what a perfect derail should be and do; and see if it is possible to fill the bill.

First.—When cleared for traffic, it should present as near as possible a solid, unbroken track.

Second.—When closed against traffic, it should be certain of deflecting anything that may run on to it and should do so with the least possible interference with the solidity of the track.

Third.—It should render it practically impossible for any derailed engine or car to reach the protected point.

Fourth.—It should, as far as possible, secure the safety of the derailed train or engine, thus enabling the engineer to remain at his post and fully utilize all the means at his command to quicken the stop.

Fifth.—It should, as far as possible, keep the derailed train or engine in such condition and position that it may be quickly returned to the track and be ready to proceed.

The first two requirements are perfectly filled by an adaptation of the old Wharton switch idea. This derail is clearly shown, closed against traffic, in Fig. 4.

The third requirement may be filled by placing the derail point at a sufficient distance from the protected point to allow the proposed addition for fourth and fifth requirements to be effective. This distance could easily be determined by experiment.

Fig. 4.—"Wharton" Derailing Switch.

The fourth and fifth requirements may both be filled by the same means, to-wit: A suitable sized channel iron, properly fastened to the ties parallel to the track, extending from the heel of each rail of the derail, so placed that the derailed wheels will enter and run along the channel. It should be not less than 5 in. deep, filled with sand; which could be coated with oil to prevent it from being blown away while waiting to be used. If deemed desirable suitable blocks of metal or wood could be fastened in the bottom of this channel to form obstructions for the wheels to rise over. It should also be possible to secure a special shape channel with sufficient flange on the bottom to permit of easy spiking to the ties. Even if 600 or 700 ft. of such a path were required to insure a stop, it would surely be much cheaper than to continue the destructive "tip-over" or the doubly dangerous alternative of running on to the crossing.

As a final move in fulfilling the fifth need I would suggest retaining the original channel-shape of the planed point rail so that the wheels may be certain of a proper return to the track when drawn back off the derail, instead of dropping down outside as they are most likely to do with the present plain point. This is well worth doing whether the channel idea be adopted or not.

Should the expense of the channel be objected to, I would suggest the economical alternative of laying a light rail, say 4 in., in a proper sized wooden trough and deep enough to insure at least 1½ in. of sand over the top of the rail.

## Maintenance of Automatic Electric Block Signals.*

### *Track Circuits.*

Practice, as to length of track sections, varies widely, as does also the equipment of electro magnets; but the method of maintaining can be made uniform.

Where the gravity cell is in use, it is generally placed in a 6 in. x 8 in. porcelain jar, about 7 ft. beneath the surface of the ground. With porcelain jars there is an absence of breakage, but glass jars are popular on account of their transparency, though breakage while in service, causing unnecessary delay to traffic, is quite an item per annum.

The following parts make up a good standard gravity cell: Two sheet copper strips about 2 in. wide and 5½ in. long, with lower edge turned over, the strips to be carefully riveted so as to make a good connection. To this copper is attached the usual rubber-covered copper wire of .066 in. M. M. D. G. gage. The object in turning over the lower edge of copper is to prevent it from being drawn to the surface of the sulphate of copper, which action interrupts the cell and frequently short circuits it by bringing the copper in contact with the zinc. Circular gravity zincs, well amalgamated, weighing not less than 4 lbs. (when new) and so constructed as to present a large surface to the elements, will be found most serviceable. The binding post on these zincs should be so arranged as to prevent corrosion of the connection. The zinc should, in all cases, be suspended from top of jar so as to be 3¼ in. above top of the copper plate. The sulphate of copper should be of large crystals, nothing which will pass through a $^{3}/_{16}$ in. square mesh being used. Crystals should be of a clear and not dull blue greenish shade.

Two cells as described should be placed in multiple arc on each track section. I find a wide difference in the practice of maintenance of such cells. There are three distinct methods:

First.—Renew one cell in each set every three weeks; set it up by the use of clear water, without any zinc solution. This gives a high resistance cell in multiple with a good cell, and reduces voltage. This rule allows each cell in a series to work six weeks without attention.

Second.—Renew both cells in each set every four weeks, using at least one pint of zinc solution, pouring it on the surface of the zinc, and not into the cell at random. Where these cells are exposed to a heavy current delivery, it may be necessary to clean the zinc and remove some zinc solution to make the cell more active.

Third.—Renew one or both cells in the series at any time they may become exhausted or the person in charge may deem it necessary to renew.

. . . The gravity cell is the proper cell for track service; Lalande, Gordon, Waterbury and similar types have been tried and their cost appears to be excessive if not prohibitive. Track batteries should, under all conditions, deliver from .9 to 1 volt and .100 to .175 amperes, in series, with a 4-ohm relay at the far end of the section.

Insulated splices and bonding should be kept in perfect condition; the earth, ash, slag or sand ballast should be free from the sides and bottom of rail at all times. In road crossings, planking should be so arranged as to allow free inspection of bond wires and all mud or ballast kept free from bottom of rail. The poor insulation of tracks at such points makes many escapes and promotes the discharge of lightning to track circuits.

The life of the bond wire is a large item in maintaining track circuits. Shall iron or copper be used, and what gage and quality? Should wires be placed behind the iron splice bars shortening the life of the wire and preventing inspection? By properly placing bond wires on outside of splice bars where they can be inspected readily and renewed an advantage is gained, as there are many chances of their being tampered with, disturbed by trackmen, cut off by derailments and torn off by objects dragging from trains.

### *Signal Circuits.*

So widely different are ideas that there is here much room for discussion. One road will place battery until the disk, clutch or slot is operated according to the desire of the person making the installation, and on another the battery is placed so as to show a given current or voltage at some given point on the circuit. The following questions may be in order:

Will a disk signal operate successfully, under all weather conditions, with a current of .125 amperes, at the required voltage, according to resistance in line? Or shall we make our standard from .175 to .225 amperes? Information at hand would indicate the instruments guaranteed to operate successfully on .080 to .100 amperes; still we find this wide range in practice. For motor signals we find the current delivery through the clutch or slot, ranges from .090 to .110 amperes.

There is a saving in zinc, by taking the unused portion removed from track batteries and placing it in service in gravity cells maintained on signal circuits; but the gravity cell requires more attention than any other used by us, and it is now only used at points easy of access and for the purpose of saving scrap zinc.

How can we make the best showing in maintenance of batteries? By the use of an iron clad rule to make renewals at stated periods or shall the men be allowed to exercise their judgment as to the proper time? With porcelain jars it is impossible to see the condition of a cell, without disturbing the solutions, which set up a high resistance in the cell. If glass jars are used, a minute inspection is possible and there is no reason for interruption of circuits. All cells will in time have some defect which we must guard against. Shall we place a signal battery in service and allow it to work until completely exhausted, thereby causing a failure? Shall we at stated intervals of from four weeks to two months renew a few cells in each nest of batteries, thus practically making a continuous battery with its consequent fluctuations in current and voltage? Shall we supply all of the men on such work with reliable (and consequently delicate and expensive) measuring instruments, so they can tell about when the cells are exhausted? Or shall we use glass jars with their ever annoying breakage, and run the battery to its full life, by insisting on inspection?

To what extent is unnecessary delay to traffic caused, where two or more signal circuits are feeding from one nest of batteries? The practice does not seem to be encouraged. It is said to be annoying when breaks occur, by blocking more than one signal; also expensive on account of the unusual amount of current drawn from the cells when all circuits feeding from it are in service, it being necessary to place and maintain several additional cells at all times to make up for this ever expected condition.

### *Maintenance Force.*

A uniformity of practice as to the handling of the maintenance end is much desired, and many plans have been devised, but there still seems to be room for improvement. Which of the plans named below would give the best result?

1. A maintainer to be responsible for all apparatus in a given territory, which will mean for him to make all repairs and renew all batteries. It may be that there are times when he cannot do all of this work; shall he then be supplied with help, and from where?

2. A maintainer to be responsible for all apparatus in a given territory and have under his charge an assistant.

3. A maintainer to be responsible, same as in the second proposition, and have a batteryman to do all battery work, and report the same as the maintainer, to the division foreman.

4. Should lampmen come under the direction of the signal maintainers or foremen?

5. Shall means be devised by which to have a line of promotion over an entire system so as to make use of all available material; or shall each division be as a separate railroad?

*A paper by H. S. Balliet, Supervisor of Automatic Signals, Lehigh Valley Railroad, to be read before the Railway Signaling Club at Buffalo. Condensed.

## For Better Car Service.

The following circular letter has been sent to the General Managers of most of the railroads by the Per Diem Committee of the Eastern Car Service Association:

"At a meeting of the Eastern Association of Car Service Officers, held in New York in May last, the following resolution was passed:

" 'That the Per Diem Committee be continued in its labors, with instructions from this Association that in their broader sense as a committee originally appointed and designed to do what seemed proper and best or most expedient for the promotion of improved methods in car service, that they be instructed and empowered by this Association to confer and co-operate with any other similar committees of other associations, or any individual or bureau or body of persons of whom they may obtain knowledge, whose apparent aim is in the same direction as that of the committee.'

"In accordance with these instructions the committee requests the active co-operation of your Association, through authorized committees or otherwise, for the purpose of securing action that will result in obtaining more service from freight cars.

"More service can be obtained. That this might be accomplished, and that we might also have a check on car earnings, committees of the American Railway Association, the Railway Transportation Association, the International Association of Car Accountants, the Central & Western Association of Car Service Officers and the Eastern Association of Car Service Officers, have recommended the adoption of a per diem plan of settlement for car service in lieu of the mileage plan now in effect.

"With a per diem plan in effect, car owners will be compensated for their use at a rate per day instead of 'mileage' or rate per mile; the rate per day will furnish an incentive for the prompt return of cars, while the mileage plan puts a premium on delay; furthermore, it will furnish a check on car earnings, while with the mileage plan there is no check whatever, the owner simply accepting what is offered.

"Per diem is an executive question in which transportation officers are particularly concerned, inasmuch as it would increase the effectiveness and thereby the value of property in their charge. It deeply concerns the traffic departments, in that the business they contract can be more satisfactorily cared for. It also concerns the treasury department, as with per diem they may know absolutely that all the revenues are properly covered into the treasury.

"It would therefore seem incumbent on all associations to give this subject the consideration and support which

its importance warrants, in order that the question may be placed squarely before the executive officers. It should be made clear to them that the mileage plan is a breeder of idleness; that idle equipment creates a false demand for more; and that unnecessary equipment is a waste of capital. It should be made clear to them, likewise, that with a per diem plan idleness will give way to activity, thus producing opposite results; that competent investigators have recommended per diem, and therefore that it is worthy of immediate and definite action."

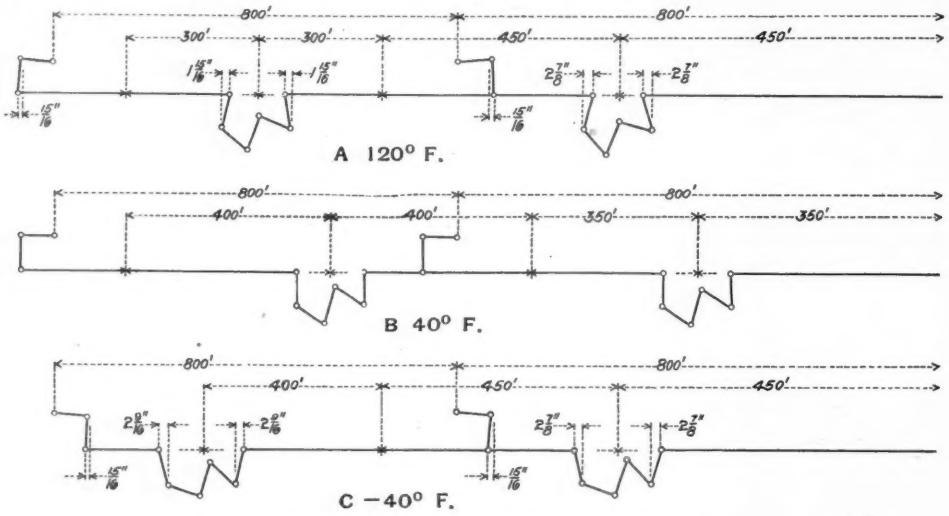
### Compensation and Crank Motion.*

It is my intention to point out a few errors commonly made in connecting pipe lines to cranks and compensators in various degrees of temperature, as well as in the use of short cranks in a long pipe-line, gaining stroke in the end of a pipe line, and in the location of compensators.

Most foremen make all connections with the crank and compensator arms at right angles to the pipe line (or on the center) when the lever is on the center, regardless of the temperature of the atmosphere. If this is done in a long line of pipe in very hot weather it will cause the crank or compensator arms to bind against the stand when the temperature falls, making it impossible to latch the lever, and by being thrown too far to one side will also bind and sometimes break the pipe carrier.

The accompanying sketch shows how the crank and compensator arms should be connected, with lever on center, according to the various lengths of pipe and the various degrees of temperature. This table was made for use in the territory covered by the Chicago Great Western Railway, 15 deg. being added to the maximum temperature "in the shade" for sun heat, and 5 deg. to the minimum for cold. It would, of course, be necessary for each road to make up its own table to suit its locality.

A common mistake is placing short arm cranks in the center of a long line of pipe; this permits the crank arms to bind on the crank stand sooner than if the arm were longer. A crank shorter than 9 in. should not be used, and these should not be used farther out in a line than 200 ft. from the lever.




Effect of Temperature on Signal Connections.

| Temp. Deg. Fahr. | Length of Pipe Line in Feet. 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 | |
|---|---|---|---|---|---|---|---|---|---|
| 120 | 5/8 | 15/16 | 1 1/4 | 1 5/8 | 1 15/16 | 2 1/4 | 2 9/16 | 2 7/8 | Inches Long |
| 110 | 9/16 | 13/16 | 1 1/8 | 1 3/8 | 1 11/16 | 1 15/16 | 2 1/4 | 2 1/2 | |
| 100 | 1/2 | 3/4 | 15/16 | 1 3/16 | 1 7/16 | 1 11/16 | 1 15/16 | 2 3/16 | |
| 90 | 3/8 | 5/8 | 13/16 | 1 | 1 3/16 | 1 3/8 | 1 5/8 | 1 13/16 | |
| 80 | 5/16 | 1/2 | 5/8 | 13/16 | 15/16 | 1 1/8 | 1 1/4 | 1 7/16 | |
| 70 | 1/4 | 3/8 | 1/2 | 5/8 | 3/4 | 13/16 | 15/16 | 1 1/16 | |
| 60 | 3/16 | 1/4 | 5/16 | 3/8 | 1/2 | 9/16 | 5/8 | 3/4 | |
| 50 | 1/16 | 1/8 | 3/16 | 3/16 | 1/4 | 1/4 | 5/16 | 3/8 | |
| 40 | | | Normal | | | | | | |
| 30 | 1/16 | 1/8 | 3/16 | 3/16 | 1/4 | 1/4 | 5/16 | 3/8 | Inches Short |
| 20 | 3/16 | 1/4 | 5/16 | 3/8 | 1/2 | 9/16 | 5/8 | 3/4 | |
| 10 | 1/4 | 3/8 | 1/2 | 5/8 | 3/4 | 13/16 | 15/16 | 1 1/16 | |
| 0 | 5/16 | 1/2 | 5/8 | 13/16 | 15/16 | 1 1/8 | 1 1/4 | 1 7/16 | |
| 10 | 3/8 | 5/8 | 13/16 | 1 | 1 3/16 | 1 3/8 | 1 5/8 | 1 13/16 | |
| 20 | 1/2 | 3/4 | 15/16 | 1 3/16 | 1 7/16 | 1 11/16 | 1 15/16 | 2 3/16 | |
| 30 | 9/16 | 13/16 | 1 1/8 | 1 3/8 | 1 11/16 | 1 15/16 | 2 1/4 | 2 1/4 | |
| 40 | 5/8 | 15/16 | 1 1/4 | 1 5/8 | 1 15/16 | 2 1/4 | 2 9/16 | 2 7/8 | |

**Table of Lengths for Use in Connecting Cranks and Compensators.**

NOTE.—*The figures in this table are approximately correct. The basis is .04 in. on every 50 ft. for 10 deg. variation in temperature.*

*A paper by C. A. Christofferson, Signal Engineer of the Chicago Great Western, to be read before the Railway Signaling Club at Buffalo.

Where derails are operated a great distance from the cabin, and by a switch and lock movement, more stroke is required than on short lines. Most foremen will leave the stroke in all the levers with pipe connections the same (usually from 8 in. to 8¾ in.), and gain stroke in the last crank next to the switch and lock movement. This is a serious error. The stroke should in all cases be gained at the lever. By having more stroke in the lever than is needed at the end of the pipe line, the strain on the entire line will be decreased; but in doing this it will be necessary to increase the length of the crank and compensator arms, and place them correctly according to the temperature.

The sketch referred to shows a pipe line 1,600 ft. long, with a line 100 ft. long branching off in the center, and a line 100 ft. long branching off at the end. I have quite frequently found foremen placing compensators in the center, between the two cranks and between crank and lever, not taking into consideration the branch line or the crank motion. These drawings show that by changing the crank motion none of the three compensators between the cranks will come on the same place. It was not my intention to say anything on this latter subject, as it is rather old, and I expect to be met with remarks to this effect. Nevertheless there are a good many foremen who do not place the compensators properly, and this is not found out until after the plant is in service and the lines commence to give trouble. I consider that all these details are worthy of much more serious consideration than they usually receive.

### The Brooklyn Bridge.

The report on the New York and Brooklyn Bridge made by Messrs. Edwin Duryea, Jr., and Joseph Mayer, was submitted to the District Attorney. Their conclusions, in brief, are:

"We find that some deterioration of the Bridge has been allowed to occur because of improper supervision and inspection, but that at present because of repairs no important deterioration exists and that the structure is practically as strong now as when completed.

"Its safety, however, due to increases in the moving loads, is less than when the Bridge was completed, and because of defects in the design has never been so great as was supposed and is now much below the degree considered good practice for ordinary bridges.

"We believe the present margin of saftey to be so small that the necessity for repairs is very urgent and have suggested means by which the safety can be largely increased without materially interfering with the traffic and at a comparatively small cost.

"We believe that present methods of supervision, inspection and maintenance to be very faulty and not such as will with any certainty keep the bridge in a safe condition."

A few passages from the report follow:

"Our examination shows us that while no serious deterioration of the structure now exists, the supervision, inspection and maintenance are at fault in not removing various influences which tend to cause deterioration.

"Our investigation shows that the stresses in cables, towers, parts of stay system, and floors, due to the most unfavorable probable combination of forces, are far in excess of those considered good and adequately safe by engineers. This is due both to increases of the moving loads above those at first contemplated and to various features of the original design.

"We consider it necessary that these excessive stresses should be reduced as soon as possible, and have suggested in the report below how this may be done at a comparatively small cost.

"An examination of the suspender rods shows that they must (because of their design) be subjected to side bending and that their failure is due to this. We believe the most important cause of side bending is wind pressure.

"At least two other causes of side bending act in conjunction with the wind pressure. An examination of the new rods which have replaced the ones which broke, shows that they are being pulled to the north by the cable and are bearing hard against the top edges of their trunnions. This must be due to some defect of adjustment or construction by which the rods fail to lie in the plane of the cable, or the trunnions fail to be perpendicular to this plane.

"The remaining cause of side bending is the only one which could have been remedied by more careful supervision. The rods were intended for use with lubricated trunnions and the trunnions show no evidence of lubrication.

"The accident showed that the rod suspenders are of insufficient strength to withstand the actual conditions existing, and that similar failures may occur on the other cables.

"It was in our opinion wise to lighten the loads on the bridge by a partial stoppage of traffic when the breaks were discovered, as the indications are that the breakage would otherwise have spread to more of the suspenders and might have reached serious proportions.

"Many of the diagonal bars and sway rods of the stiffening trusses have been allowed to wear by rubbing against each other, and many of the suspender ropes by rubbing against the floor of the promenade.

"The saddles supporting the cables on tops of towers, now fixed, were intended by the designers to be movable. Our inspection shows ridges of rust, paint and dirt being found on the bed-plates along the outer rollers.

"Such deterioration as has occurred has not appreciably diminished the strength of the structure as a whole. The bars and rods which have been somewhat worn by rubbing were larger than necessary to begin with, and are still of ample strength for their duties. The same is true of such members as have had their sections reduced by rust. The immovability of the saddles increases the stresses in tower masonry considerably, but in another way exerts a good effect on the Bridge by keeping the stresses in cables at center of main span lower than they would if the saddles were movable.

"If the safety is found to be defective this may be due to any one of the following four causes: (1) Physical deterioration of its materials or members. (2) Changes made in the structure since its completion. (3) Increases of moving loads beyond those for which the Bridge was designed, and (4) Defects in the original design.

"Physical deterioration might ensue from a reduction of the sections of members by rusting or wearing or from a reduction in the strength of the steel due to a repetition of stresses near the elastic limit. The latter cause cannot have occurred except in a few details, notably the stirrups of stays and of some of the suspenders and in the suspender rods near the center of main span. The physical examination shows that the reductions of sections by rust and wearing are in no case serious and do not exist in the members having the smallest factors of safety. Electrolysis has often been mentioned in newspapers as a possible cause of weakening of the Bridge. This is merely a form of rust caused by electricity under certain conditions and there is no evidence that these conditions exist in the Bridge. In our opinion no material loss of strength from physical deterioration has occurred in the Bridge.

"The only change in the structure known to us is a lightening in the weight of railroad floors by widening the spaces between ties and omitting the tie spacers (guard rails). This change reduces the safety of the structure locally in case of derailment, but if it had not been made, the already too small factor of safety in the cables would have been still smaller.

"The moving loads on the span as a whole are much larger than those proposed by the designer.

"No change in the spacing of trolley cars—except such a large one as would seriously interfere with the use of the Bridge—can effect any decided increase in the safety of the Bridge. The restrictions as to minimum spacing of cars should be strictly enforced."

"Much has been published as to the large weight of extraneous dead load on the Bridge in the form of mail tubes, telegraph and telephone cables, etc. We have found no useless dead load on the Bridge and the combined weight of mail tubes and telegraph and telephone wires is only 1.5 per cent. of the total moving and dead load.

"It is evident that of the three causes just described only one—the increase in the moving load—has had any serious effect in decreasing the safety of the Bridge. This loss of safety could, of course, be recovered by reducing the moving loads to their former amounts, but to do this would reduce the usefulness of the Bridge very greatly and should not be considered except as a very temporary arrangement or a last desperate expedient.

"Because of certain unperceived defects in the original design, however, the Bridge has never actually been as strong or as safe as it was believed to be. Those defects are of such a nature that, although serious in their effect, they can be remedied in a comparatively short time and at a comparatively small cost. It is believed, also, that when these defects are removed the Bridge will not only be safe under its present loads, but that these loads may even be safely increased. The safety of the Bridge, therefore, should be increased by remedying the defects in the design.

"Excessive stresses in cables at the center hinge or slip-joint are the most serious cause of danger in the Bridge. Our calculations show the maximum stresses

to be, if no account is taken of the loads borne by the stay system:

| | | | | | |
|---|---|---|---|---|---|
| From fixed and moving loads..... | 44,800 | lbs. | per | sq. | in. |
| " bending of cable as a whole... | 28,600 | " | " | " | " |
| " bending of individual wires... | 2,000 | " | " | " | " |
| Total ..... | 75,400 | " | " | " | " |

"The stay system does carry some of the loads, though it is impossible to say how much, since the original adjustment has been changed by the failure of the bottom chords in 1898. It is believed that if the stresses in the cable from fixed and moving loads are assumed to be reduced 10 per cent. because of the help afforded by the stays, an ample allowance will have been made. The strength of the stay system is greatly reduced by the weakness of its end connections, in which failure would occur long before the strength of the ropes is reached.

"If the 75,400 pounds per square inch stress above be reduced by the amount which may perhaps be eliminated by the stays, the stress in the cables from above cause is 71,000 pounds per square inch. This is about 18 per cent. in excess of what we regard as the permissible working stress, 60,000 pounds per square inch. This stress of 71,000 pounds is, however, increased by the wind pressure, but to what extent is not yet known. The condition, therefore, is a very serious one—that of a stress in the cables much above the safe limit, but with its exact amount unknown.

"Means by which the stresses in cables due to bending may be largely reduced are described in Appendix D. They consist in removing the wrapping from cables for a few feet at each slip-joint and using sleeves at these points to fix the least radius in which the cables can bend. We believe that by these means the bending stresses may be reduced to one-fifth or less of their present amount and that the work will entail no serious interruption to traffic, can be completed within three or four months after the money is available, and at a cost of perhaps $30,000.

"The transference of the wind pressures from the trusses to the cables through the rods causes bending in the rods, and we believe this cause alone is sufficient to account for their failure. A new design should be adopted by means of which tension only would occur in the suspenders. The wind pressures should be transferred from floor to cables by a separate detail.

"The maximum pressure existing in the masonry of the towers, with saddles immovable as at present, is (neglecting wind pressure) at least 39.6 tons per square foot. The exact amount is uncertain and may be considerably more. The working stress should not be more than 20 tons per square foot. Making the saddles movable would reduce the maximum pressure to about 35 tons per square foot and would diminish the present uncertainty as to the exact amount; it would, at the same time, however, increase the stresses in the cables from bending, already too high and not accurately known.

"A means has been suggested in Appendix F and shown in outline by which the pressure in the masonry can be reduced to about 25 tons per square foot. It would at the same time reduce the stresses in the cables and anchorages to an extent sufficient to permit strengthening the floors and increasing the moving loads by relaxing the restrictions on spacing of trolley cars, without harm to the Bridge from the resulting additions to its weight.

"This improvement consists in strengthening the stay system, releasing the saddles from their fixed positions and adding anchorages under each shore span.

Main Floor Beam.—The actual stress in the chords is 15,500 pounds per square inch, and the working stress should be only 14,000 pounds. The larger stress is, however, the result of increase in the loads and not of defects in the design. The stress can easily be reduced to the desired working stress by increasing the length of the cover-plates.

"Intermediate Floor Beams of Railroad Tracks.—The actual stress is 27,000 pounds per square inch and should be only 14,000 pounds. The excess is due partly to defects in the design and partly to increase in loads.

"Intermediate Floor Beam of Roadway.—The stress is 25,000 pounds per square inch and should be only 14,000 pounds. The wheel loads have not been increased.

"Channels Supporting Intermediate Floor Beams.—These along the outer high truss have stresses of 34,000 pounds per square inch and those along the inner high truss 17,000 pounds. The excess is due partly to design and partly to increase in loads. The working stress should be only 14,000 pounds.

"Wooden Stringers of Railroad Tracks.—These have actual stresses of 1,750 pounds per square inch and should have only 1,300 pounds. In cases where the joints come between floor beams the stringers have still less strength, and most of the wheel load must be carried by the rail. This is extremely bad practice.

"If the improvement of stay system is made so that the dead weight of Bridge may be safely increased, all of above defects can be easily remedied. While we have made no plans or estimates and the statement is merely a guess, we think that the entire improvement can be made at a cost of from one-half to three-quarters of a million of dollars and within less than three years' time."

## Ventilating the New York Central Tunnel.

Before the end of the month contracts will be let for changes designed to ventilate a part of the Park avenue tunnel. The plan is to tear out the walls in the 10 blocks between 56th street and 66th street and substitute iron pillars to sustain the central part of the tunnel roof. Between the points mentioned the roof of the tunnel is flat. There is an opening 20 feet wide the entire length of the roof of the main tunnel. It is believed that this will clear the tunnel of noxious gases and enable the company to continue to use locomotives with banked fires.

The illness of Mr. Wilgus has delayed the scheme for the ventilation of the signal cabins in the tunnel at 59th, 72d, 86th and 96th streets by means of 6-in. cast-iron pipes, through which fresh air will be forced by small motors.

The plans prepared in the engineering department show that the walls separating the central tunnel from the side tunnels will be torn down to within 6 or 8 feet of the roadbed. These low walls of masonry will be left for the purpose of protecting the bases of the pillars and trains on the other tracks in case of derailment. The iron pillars will be placed 17 feet apart. To strengthen the side walls new masonry will be placed inside the old masonry now supporting the arch. What the engineers would like to do is to remove the entire roof, with the exception of a slight overhang on each side of the tunnel. But the owners of abutting property would have to be reckoned with before such a step could be taken. If the plan now to be tried works in the ten blocks involved it will be extended.

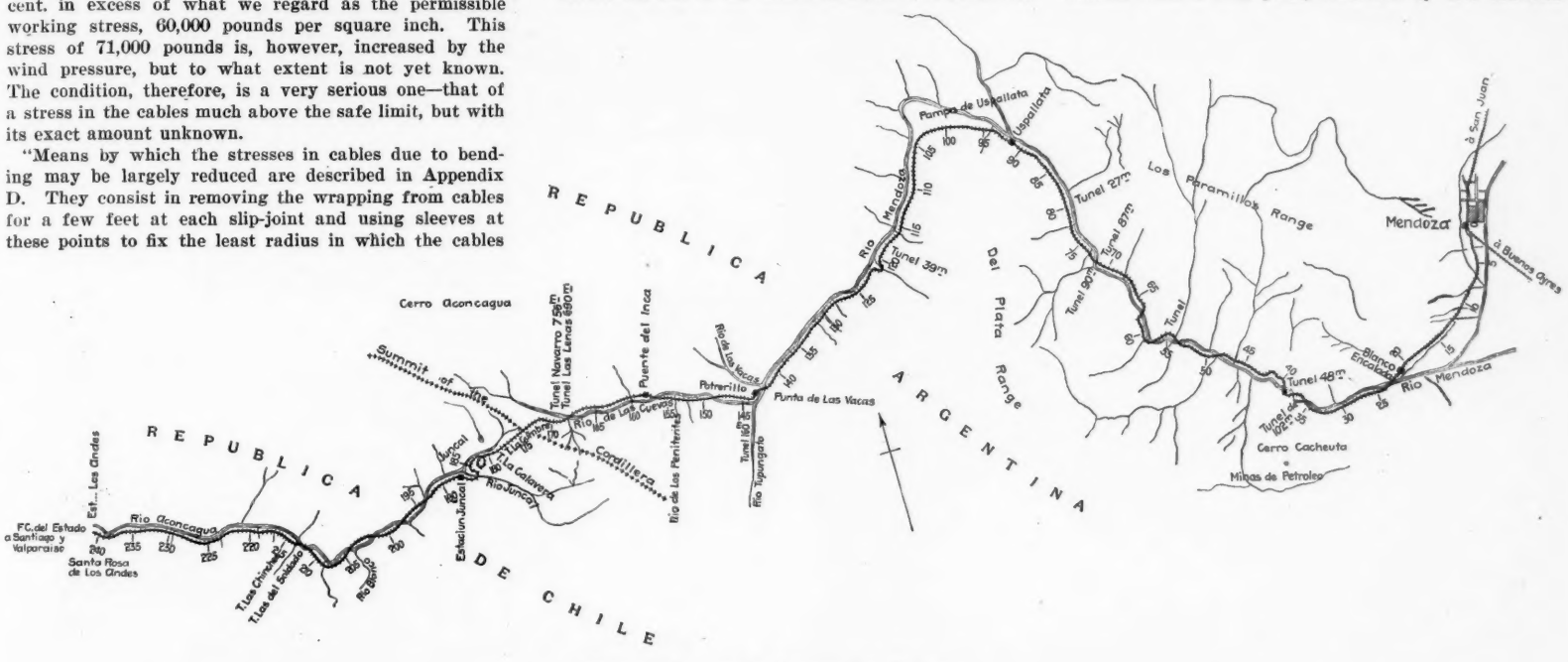
## Buenos Ayres and Valparaiso Transandine Railway.

BY ARTHUR H. SLEIGH.

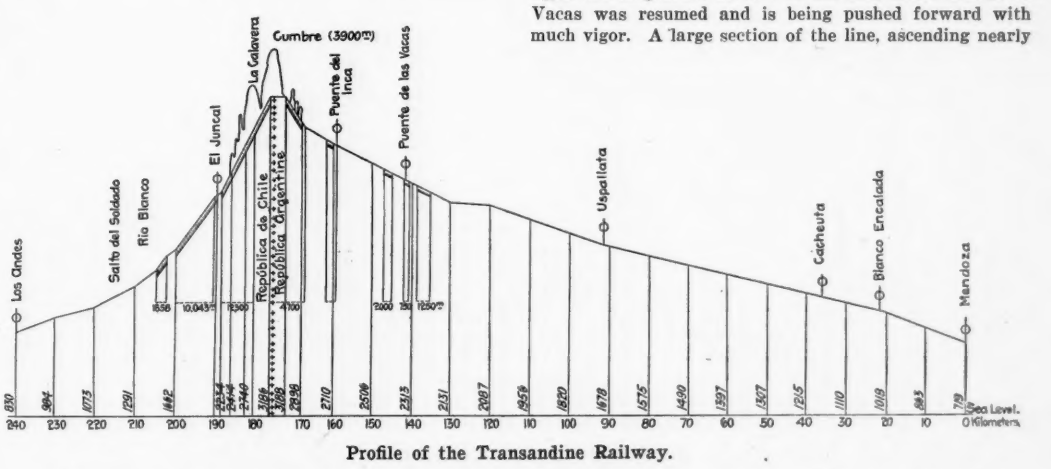
This railroad will be the most important road in South America. It is designed to connect, by a meter gage line, via the Uspallata Pass, the broad gage Argentine roads (the Buenos Ayres & Pacific Railway and its continuation, the Argentine Great Western Railway), with the broad gage State Railroads of Chili. By means of it the Atlantic and Pacific will be united by a direct route 1,434 kilometers in length. A company was formed in London in the year 1886 to take over a concession with a 7 per cent. guarantee for 20 years, granted originally by the Argentine Government in 1874 to Messrs. J. E. & M. Clark & Co., to build and work a meter gage line from Mendoza to the summit of the Cordillera de los Andes, to connect with a similar concession to start from Santa Rosa de los Andes, granted to the same firm by the Chilian Government. The accompanying reduction from a blue print, furnished by Mr. Malcolm Grant Dalton, General Manager and Resident Engineer of the line, shows that the rails ascend the valleys of the Rio Mendoza up to the junction of the Rio Tupungato with the Rio de la Vacas. They are to ascend thence by the valley of the Rio de la Cuevas to a point 10,500 ft. above sea level; there to pass from the Argentine to the Chilian slope of the Cumbre, or Summit range, by a tunnel 5,065 meters long, followed almost immediately by a second tunnel 3,730 meters long, and to descend by the valleys of the Rio Juncalillo and of the Rio Aconcagua to the plains of Chili.

Work was begun early in 1887, and in February, 1891, the first four sections, Mendoza to Uspallata, 92 kilometers, were opened to public service. In May, 1892, the fifth section to the Rio Blanco, at kilometer 121, was also opened to service. In December, 1893, the sixth section was also available for trains up to Punta de Vacas at 143 kilometers from Mendoza. On the Chilian side the works were begun and were carried up to "Salto del Soldado" (The Soldiers' Leap), 27 kilometers from Los Andes, up to which point trains now run. The total length of line to connect Mendoza and Los Andes is some 243 kilometers, so that a gap of 73 kilometers has yet to be filled.

Unfortunately, since 1892 and up to last year, but little was done to advance the rails, owing to questions of the guarantee, which had fallen in arrears. Last year, however, work was resumed on the Argentine side, whilst on the Chilian, the Government has decided to complete the line as part of the State system. Work upon the Argentine section of the line above Punta de Vacas was resumed and is being pushed forward with much vigor. A large section of the line, ascending nearly




General Plan of the Transandine Railway.




Profile of the Transandine Railway.

*The distances are in kilometers; the heights in meters. The rack sections are hatched. On these the grade is from 5.5 to 8 per cent.*

to Las Cuervas Camp, kilometer 173, is almost completed. In March of this year the first part thereof was nearly finished, up to Puente del Incas, a natural arch of 70 ft. span and 90 ft. wide, spanning the river Cuevas at a height of 65 ft. above the water. The arch is formed of gravel, cemented into a solid, concrete mass by the action of the carbonate of lime and oxide of iron deposited by the mineral springs in its vicinity. It is possible that at the present writing the section up to Puente del Incas may be in operation. Messrs. Hopkins, Gardom & Tetley, of Buenos Ayres, are building the section in question. The work involved in the construction of the line is heavy.

The following is a brief summary of the chief completed works and their position with relation to Mendoza.

| Localities. | Elevation above sea level Kilm. | Meters. | Feet. |
|---|---|---|---|
| Mendoza | 0 | 719 | 2,350 |
| Cacheuta Station | 39 | 1,196 | 3,920 |
| Uspallata | 92 | 1,702 | 5,570 |
| Punta de las Vacas | 143 | 2,333 | 7,650 |
| Puente del Inca | 160 | 2,710 | 8,870 |
| Las Cuevas Camp | 173 | 3,188 | 10,450 |
| Summit of Railroad | 175 | 3,200 | 10,500 |
| Summit of Ridge of Pass "La Cumbre" | 175 | 3,900 | 12,800 |
| La Calavera Valley | 178 | 3,022 | 9,900 |
| El Portillo Plains | 180 | 2,810 | 9,250 |
| El Juncal | 190 | 2,218 | 7,250 |
| Guardia Vieja | 200 | 1,662 | 5,440 |
| Salto del Soldado | 213 | 1,276 | 4,180 |
| Los Andes | 243 | 830 | 2,720 |

It will be seen from the above table that, of the slopes to be surmounted, the Chilian side is much more abrupt than the Argentine. From the summit tunnel the descent in the direction of Los Andes is 5,000 ft. in a distance of 25 kilometers, whereas, in the direction of Mendoza, 85 kilometers are required to accomplish the same descent. The foregoing elevations are, with the single exception of the Summit ridge, all levels of the bottom of the valleys traversed by the rails, which, throughout, are bordered by mountains rising from 9,850 ft., near the lower extremities, to 18,000 ft. above sea level, in the upper portion of the line, while these heights are surpassed by the masses of Aconcagua 24,000 ft., and Tapungato 23,000 ft., which, to the north and south of the pass respectively, flank the valleys.

BRIDGES OVER PRINCIPAL RIVERS, ARGENTINE SIDE.

| | | | |
|---|---|---|---|
| Kilm. 24 | Viaduct of 6 spans of 20 meters | ..... | |
| " 36 | Bridge of 45 meters span | ..... | Mendoza River. |
| " 37 | " " 40 " " | 6 viaduct | |
| " 39 | " " 45 " " | 6 viaduct | |
| " 48 | " " 15 " " | ..... | Dry torrent bed. |
| " 49 | " " 75 " " | ..... | Mendoza River. |
| " 54 | " " 75 " " | ..... | Mendoza River. |
| " 59 | " " 75 " " | ..... | Mendoza River. |
| " 62 | " " 75 " " | ..... | Mendoza River. |
| " 72 | " " 60 " " | ..... | Mendoza River. |
| " 78 | " " 20 " " | ..... | Dry torrent bed. |
| " 141 | " " 20 " " | 6 viaduct | Tupungato River. |
| | *Chilian Side.* | | |
| " 213 | 15 meter arch bridge | ..... | Aconcagua River. |

Of smaller bridges of 10 and 5 meters and of culverts from 5 meters downwards, there are over 300.

*Tunnels.*

In the line already constructed are the following:

*On the Argentine Side.*—Kilm. 36, 102 meters; Kilm. 39, 48 meters; Kilm. 52, 40 meters; Kilm. 56, 20 meters; Kilm. 56, 45 meters; Kilm. 70, 87 meters; Kilm. 71, 90 meters; Kilm. 82, 27 meters; Kilm. 114, 39 meters; Kilm. 114, 5 meters.

*On the Chilian Side.*—Kilm. 213, 66 meters; Kilm. 213, 41 meters; Kilm. 213, 63 meters; Kilm. 213, 240 meters; Kilm. 219, 69 meters; Kilm. 219, 47 meters; Kilm. 224, 12 meters; Kilm. 224, 35 meters.

Throughout there is much heavy work in cutting, both in gravel and rock, and extensive defenses have been required to protect the line against river floods. The work remaining to be done will also be of a most interesting nature, involving, among others, tunnels at the summit of 5,065 meters at Kilm. 175, and 3,730 meters at Kilm. 179. As to the elevations to be surmounted, some idea thereof may be formed from the following table of altitudes of successive important points along the line.

low, on the western slop of this range. As the strata consist of black, white, greenish and brown-colored rocks, interspersed with brightly tinted, lilac, purple and red porphyries, a most extraordinary view is presented. After crossing the 10-mile wide Pampa of Uspallata, which divides the outer range from the main Cordillera, the rock is porphyry, alternating with clay slate, then gypseous strata, and, near the summit, red sandstones. The descent of the western slope is through porphyries and porphyritic conglomerate, which are prolonged the whole distance from the summit to the point where the river Aconcagua debouches on the plain of the same name.

Though, at many points, and especially as the summit is approached, heavy work in cutting and tunneling has been required, nevertheless the engineering difficulties of the route have been lightened considerably by the fact that the main valleys on both flanks of the Cordillera still have their bottoms filled up to a considerable thickness by a mass of rudely stratified shingle. At many points and for distances of several miles, the greater part of this mass has been removed by torrents; cliff-bounded fringes, more or less continuous, being left at corresponding heights on both sides of the valleys. These fringes, "barrancas" as they are called, have a smooth surface, and as the valleys rise they gently rise with them; hence, they afford great facilities for the construction of roads. The accompanying picture of part of the "Gran Barranca" exhibits the formation particularly well. It is described by Darwin in "Geological Observations." In width the barrancas vary much, in some places being barely broad enough for the road, and at others expanding into narrow plains. At kilometer 121 the line is forced to descend from the top of the barranca to the river bed, and at kilometer 136 the first section of the rack is introduced, to enable trains to re-ascend to the top of the barranca. At a height of from 7,000 to 9,000 ft. above sea level the barrancas become more and more broken and finally disappear, to reappear again, however, on the opposite slope of the Cordillera.

The road, except where the rack is introduced, is built on a 4 per cent. grade. There are to be on the Argentine slope the following five sections of rack of the Abt type:

| | | |
|---|---|---|
| 1,250 meters of | 6 | per cent. grade. |
| 750 meters of | 6 | per cent. grade. |
| 2,000 meters of | 5.7 | per cent. grade. |
| 2,000 meters of | 5.7 | per cent. grade. |
| 4,700 meters of | 8 | per cent. grade. |

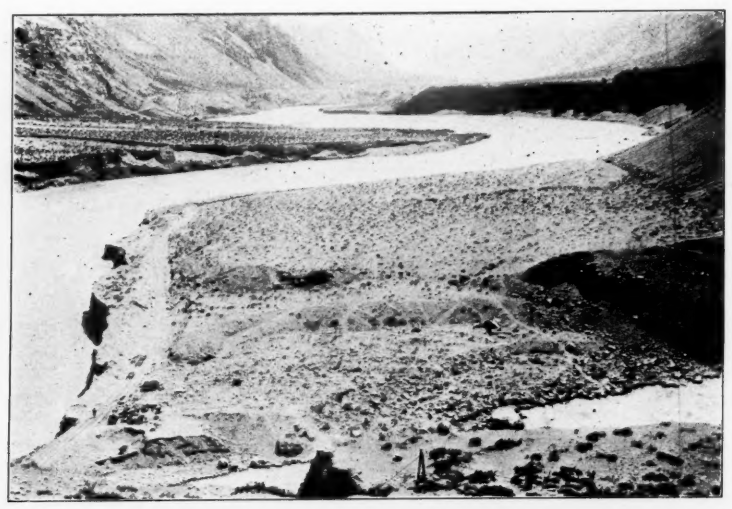
The first and second of the above sections are already in operation.

On the Chilian slope, descending from the summit, are to be the following sections:

| | | |
|---|---|---|
| 12,300 meters, of | 8 | per cent. grade. |
| 10,030 meters of | 5.5 | per cent. grade. |
| 1,858 meters of | 8 | per cent. grade. |

None of these sections are yet built.

Bridge Destroyed by Mud Run—Kilom. 78.



Rio Blanco—Ancient Mud Run and Recent Washout.

Forty-Metre Bridge at Kilom. 37—Transandine R. R.

Salto del Soldado (Soldier's Leap)—Tunnel and Bridge.

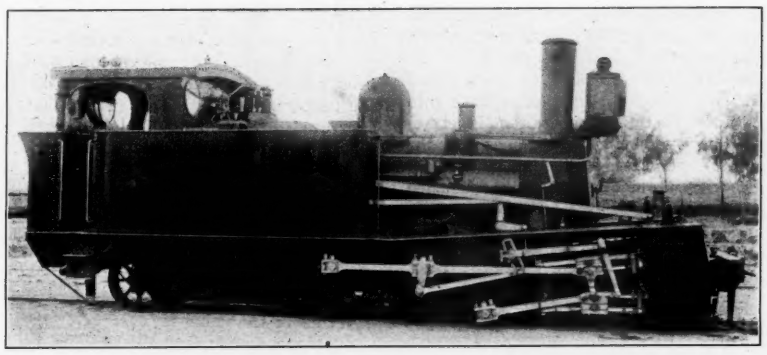
The following locomotives are used: Six-coupled side tank engines, by Dübs & Co., Glasgow; combined four-coupled and rack engines, Abt system, by Beyer, Peacock & Co., Manchester. The latter are of 45 tons and haul 70 tons.

Extensive works are required, and have been constructed, in part, to guard the line against destruction by river floods and mud-runs. Last year, and during the preceding year, much damage was done by mud-runs. Long sections of roadbed, with the parts of the barranca supporting them, disappeared entirely; bridges were destroyed by having their masonry sucked out and swept away. The mud-run, the terror of that part of the Cordillera, originates as follows: In a given valley, extending perhaps 20 kilometers or more up into the mountains, rock will have been disintegrating for a long period of years, during which, owing to the aridity of the whole of that region in South America, rain will not have fallen. When rain does come the downpour rarely lasts more than 40 minutes, but in that time from 6 to 7 in. of water may fall. The first downpour merely wets the ground; the second begins to move the debris; at the third downpour the mass begins to flow; so that within 15 minutes after the commencement of a storm, the whole surface of the valley is in motion, carrying everything before it. In the storm of 1900 it is estimated that over 3,000,000 cubic meters of mud came down in 15 minutes. An eye-witness observed a boulder, estimated at 10 tons in weight, carried without sinking on the crest of a wave of mud.

Snow interferes with traffic in winter in the most elevated sections of the line. A Rotary snow plow, by the Cooke Locomotive & Machine Company, Paterson, N. J., has recently been imported and put together in the Transandine Company's shops at Mendoza. The shops in question turn out a good deal of work, formerly imported, and are being made more complete each year. The company now has a foundry, makes its own ties and bolts, and constructs its own flats and box cars.

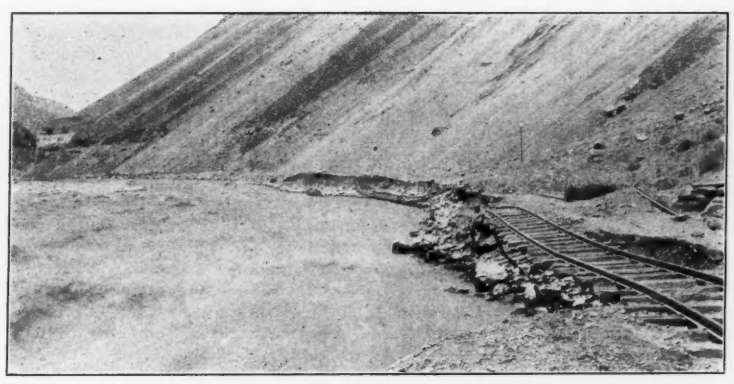
In the incomplete state of the undertaking, but little idea of its importance can be formed, though the route is already used by over 10,000 persons annually, who, by this means, can travel between the east and west coasts in three days against at least 10 days by way of the Magellan Straits, besides economizing two-thirds of the cost. The steamship companies have recognized the route as a serious opponent, as through tickets are now obtainable. Passage across the unfinished gap is by coach and mule, supplemented by an excellent baggage mule service. Two express companies, Villalonga's and the Transportes Unidos, vie with each other in affording really excellent facilities, over the entire route between east and west coasts, at very reasonable rates. Their system and management cannot be too highly praised.

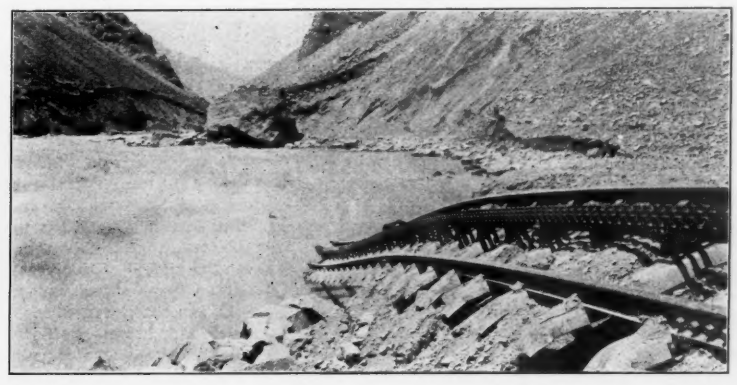
The officers of the company at Mendoza are: Mr. Malcolm Grant Dalton, General Manager and Resident Engineer; Mr. George L. Boag, Secretary; Mr. George H. Darby, Locomotive Superintendent. The above details are from data furnished by the officers of the company, and from their report in the *Argentine Commercial Guide*. The geological notes are from Darwin's "Geological Observations."



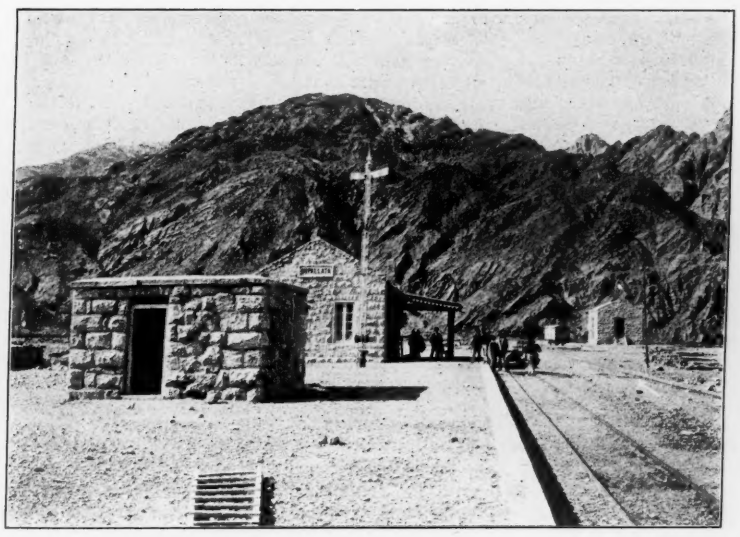
**Combination Rack and Adhesion Engine—Abt System.**

*Built by Messrs.* Beyer, Peacock & Co., *Manchester, England.*





**Washouts by Mud Runs—Transandine Railroad.**



**Uspallata Station—Transandine R. R.**

**Paranillo de las Vacas.**

On the Saxon railroads in 1900 only one passenger in 400 traveled first class, while about ten-elevenths took third or fourth class tickets.

### Some Experiences With Friction Draft Gear.

A record of results obtained from the use of Westinghouse friction draft gear on the fifty-ton steel cars of the Butte, Anaconda & Pacific Railway, has recently been compiled from the Car Foreman's record, and is confirmed by officers of the road.

The Butte, Anaconda & Pacific road has 520 fifty-ton Pressed Steel Car Company's ore cars, all of which are fitted with the Westinghouse friction draft gear and used in ore traffic between the mines in Butte and the smelters in Anaconda, Montana. The comparative records given below are for 155 of the above 520 cars, five of which were placed in service August, 1898, and the remaining 150 in June, 1900; the remainder of the 520 cars having been placed in service more recently. The couplers on these cars have 6-inch shanks, excepting the five cars first in service, which have 5-inch shanks.

One of the connecting lines of the Butte, Anaconda & Pacific has a number of similar steel cars, equipped with twin-spring draft gear, also having couplers with 6-inch shanks, and used in the coal traffic over the Butte, Anaconda & Pacific, to the smelters in Anaconda and the mines in Butte.

The record of draft-gear failures and mileage made for the six months from Nov. 1, 1900, to May 1, 1901, on fifty-ton steel cars, both foreign and home, on the lines of the Butte, Anaconda & Pacific Railway, is as follows:

| | Failures. | | Car mileage. | | Ratio of mileage. | |
|---|---|---|---|---|---|---|
| 1900. | For'n. | B. A. & P. | For'n. | B. A. & P. | For'n. | B. A. & P. |
| Nov. ... | 18 | 0 | 14,455 | 149,820 | 1 : | 10.3 |
| Dec. ... | 20 | 1 | 17,183 | 146,040 | 1 : | 8.4* |
| 1901. | | | | | | |
| Jan. ... | 18 | 0 | 22,356 | 139,800 | 1 : | 6.2 |
| Feb. ... | 10 | 0 | 13,263 | 97,380 | 1 : | 7.3 |
| Mar. ... | 13 | 1 | 11,637 | 131,640 | 1 : | 11.3† |
| Apr. ... | 11 | 1 | 15,535 | 149,220 | 1 : | 9.6 |
| | 90 | 3 | | | | |

The average monthly mileage of foreign fifty-ton steel cars on the Butte, Anaconda & Pacific was 15,738 miles, while the average monthly mileage of the Butte, Anaconda & Pacific cars was 135,650, or 8.6 times greater.

The yokes on the foreign cars were of 1-in. x 4-in. iron, while nearly all of those on the B., A. & P. cars fitted with friction draft gear were of 1-in. x 4½-in. iron. Of the 90 breakages of draft gear on foreign cars, 25 were broken yokes. Deducting this number on account of yokes being unlike, we have 65 couplers and knuckle breakages on foreign cars to three on the B., A. & P. cars, or more than 21 times as many. On an equal mileage basis, the breakages on foreign cars were 185 times as many as on the B., A. & P. cars fitted with the friction draft gear. It is assumed that the couplers on foreign cars were of equal strength with those on the B., A. & P. cars, and as all of the former had the extra large 6-in. shank, and, therefore, were designed for

*Three B., A. & P., and three foreign cars had sills damaged in a collision, and two of the latter had couplers broken.
†Friction draft gear cylinder found cracked two weeks earlier.

especially severe service, this assumption seems justified. The breakages on foreign cars were divided as follows:

35 couplers.
30 knuckles.
25 yokes.
—
90

On B., A. & P. cars but three couplers were broken and no knuckles or yokes, this comprising the entire breakage of draft attachments in six months' service. Compared with 35 broken couplers on foreign cars, and allowing for the home cars making 8.6 times greater mileage, the breakage of couplers only, on an equal mileage basis, on the foreign cars with the double-spring draft gear was 100 times as great; or, 300 couplers, instead of three, would have been broken on B., A. & P. cars had they been equipped with the spring draft gear.

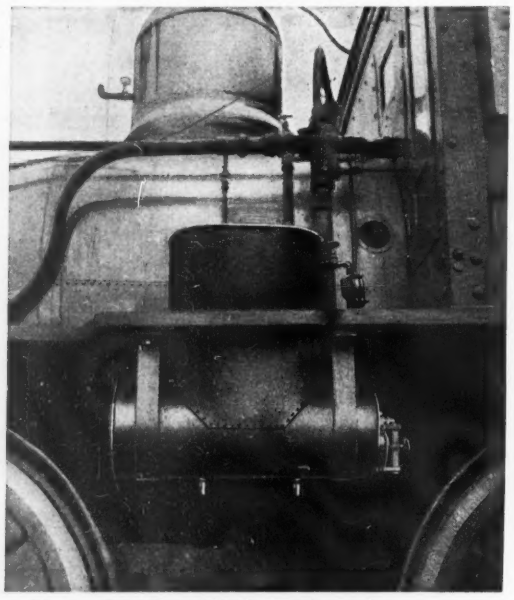
The saving in coupler breakages only in six months' service, by the use of the friction draft gear on 155 cars, as shown by the above record, was enough to pay the entire cost of the friction draft gear with which they were equipped, the saving in broken knuckles and yokes being additional and in the nature of an increased interest—and a large one—on the investment.

The ore service on the B., A. & P. is severe, as the grades are steep, reaching 132 feet per mile, while the locomotives are very heavy, those used between terminals being eight-wheel-connected Schenectady compounds. Trains of 50 and 60 loads are handled one way and empties the other, all the air brakes on the latter rarely ever being used, resulting in additional severe strains on the draft gear.

At each terminal the switch engines work on heavy grades, enabling them to handle but few cars at a time, which causes a great deal of switching and an unusually severe service for the draft attachments.

## Acetylene Gas Generator for Locomotive Lighting.

For the past six months the Chicago & North Western has been experimenting with a new apparatus for lighting the locomotive with acetylene gas and the reports of these service trials are highly satisfactory. The apparatus tested is patented by Mr. E. R. Cook, and the exclusive license to manufacture and sell is held by the Railroad Supply Co., Chicago, which company is now ready to put the apparatus on the market.



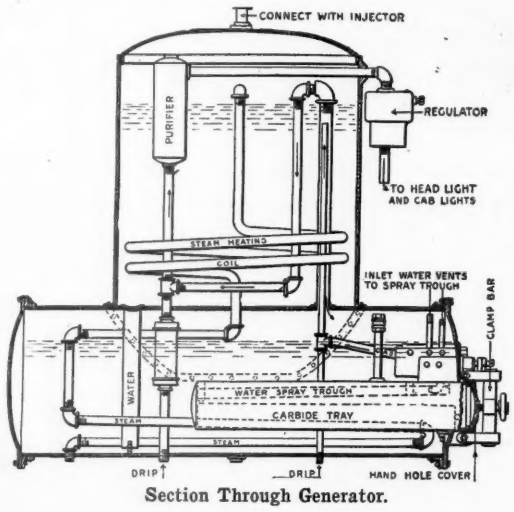
Location of Acetylene Generator.

A test of this lighting system on the North Western, between Chicago and Clinton, Iowa, with a locomotive hauling the limited trains gave the following result: The headlight was equipped with a ¾-ft. burner and the steam gage and water glass lights each had a ¼-ft. burner, making a total consumption of 1¼ cu. ft. of gas an hour. In seven consecutive nights the lights burned in all 50 hours and 45 minutes and the total amount of carbide used was 12½ lbs., costing about 50 cents. Experience has shown that the apparatus is reliable; it requires no special instructions as to its handling; it does not flicker when the engine is running at high speeds, and there are no complicated parts to be maintained and repaired. The cost for lighting the headlight alone with acetylene gas is found to be about ½ cent an hour, and if gas is used as well for all the cab lights the cost is about 1 cent an hour while running. With the ordinary reflector and burning ½ cu. ft. of gas an hour in the headlight, the track is illuminated from 1,000 to 1,600 ft. ahead of the engine.

The construction of the generator is shown by the accompanying engravings. This is a T-shaped tank 30 in. high and 15 in. in diam., placed directly under the running board on the left side of the engine just ahead of the cab. The vertical portion of the generator contains water, together with the purifying and washing apparatus. The lower, or horizontal portion, contains a chamber for water and gas, and into this space two cylinders project which are cast integral with the head of the generator. Each cylinder contains a carbide tray and a small trough for distributing the water. The front ends of the carbide chambers are closed by hand-hole covers. These parts are all clearly shown in the line drawings.

The water enters the carbide chamber through the small tubes marked "inlet water vents," and the gas passes out through the gas pipe which extends up into and nearly to the top of the upper drum. This pipe is encased in a larger pipe opening into the gas chamber of the lower drum. The gas being generated in considerable quantities is forced back into the lower drum and cooled and washed. From this chamber it passes through the purifier and regulator to the service pipes.

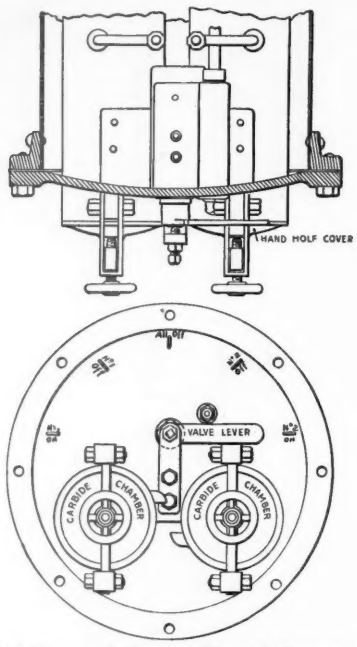
It will readily be seen that when the consumption of gas is slightly more than that generated the water rises in the lower drum and so enters the shorter tube into the carbide chamber. When the generation is excessive the water in the lower drum is forced back into the upper drum so that no more water reaches the short inlet tube. When the carbide in one of the trays is exhausted




Section Through Generator.

the water rises in the lower drum and enters the higher inlet tube leading to the opposite carbide chamber. These small inlet tubes are hooded so that the water must rise from below to enter them; otherwise the action might be disarranged by the water swashing from side to side, due to the motion of the locomotive. The pressure of gas can at no time exceed the weight of the column of water in the generator, equivalent to about 1 lb. per sq. in. The generator has an overflow at the top so if it were possible to generate a greater pressure, the water would be forced out and the excess gas would escape to the atmosphere. The coiled pipe shown in the water tank is for connection with the steam pipe to prevent freezing in cold weather.

In charging the generator, the valve lever is put in the vertical position. The hand-hole covers are then removed and the carbide trays taken out. When cleaned and supplied with a proper amount of carbide, the trays and covers are replaced. The apparatus is now ready for use. When it is desired to use the light, the lever is turned to either of the horizontal positions when the




End View and Section Through Generator.

machine automatically commences to generate gas. Any after-generation in the carbide chambers escapes through the vertical pipes and lift-valves to the gas chamber in the top of the horizontal drum. The generator is filled with water through a connection with the locomotive injector. Drip valves drain the purifier and gas pipes.

## Baltimore and Washington Car Service Association.

Manager A. L. Gardner has issued the 11th annual report of this Association. It is for the year ending August 31. The principal totals shown are:

| | |
|---|---|
| Cars handled | 601,665 |
| Earnings | $72,293 |
| Collections | 60,933 |
| Net revenue | 35,625 |
| Uncollected (including previous years) | 2,935 |
| Refunded this year | 11,159 |

The amount refunded is 54 per cent. of the total of the 1,041 claims received and investigated. In the report the Manager says:

"During the eleven years' operation of the Association there has been handled under the rules 4,953,407 cars, with an average detention of about one and one-half days per car, producing net revenue (exclusive of all expenses and refunds) amounting to $142,760. The business has steadily increased each year since 1897, and the past year shows a marked increase, in every detail, over any previous one. While the total number of cars handled increased but 03.24 per cent. over last year, there is an increase of 38.60 per cent. in the earnings, and of 39.89 per cent. in the net revenue. The operating expenses were 23.22 per cent. of the total collections, and the net revenue 5.92 cents per car. Of the earnings, 84.29 per cent. have been collected. The uncollected charges to date are $2,935. This is larger than it should be. Car service earnings should be accounted for and collected in the same manner as freight earnings.

"The membership of the Association consists of 24 railroads, and daily reports are received from 612 stations."

It will be observed that Manager Gardner adheres to the principle, enunciated by him in his paper recently read before the Car Service Managers' Association, that the earnings of cars should be recorded and reported, whether such earnings are collectible or not.

## Some of the Duties of Mechanical Officers.*

To maintain an efficient organization, not for one year but indefinitely, to have for the heads of departments men of character and ability, to operate progressively and economically, to properly manage men and to have loyal and effective co-workers are some of the more important duties of mechanical officers. . . .

It may be readily seen that all of these questions involve, more than any one thing, the element of men, for after all it is the man that conceives and the man that executes, and in fact the man that gets results in one way or another rather than systems or things. But taking these duties one at a time, let us consider briefly some of the underlying principles of each.

Considering first the matter of organization, it appears to the writer that the principle of having authority and discretion go with responsibility is the one above all others that is most important in obtaining the best results. Compare this with those other conditions sometimes existing where the responsibility is imposed and the authority restricted, or where both responsibility and authority are restricted to an unreasonable extent, and judge which condition is likely to effect the best results.

The first condition implies executives fit in every way to carry the responsibility; it requires that men shall be responsible and maintains action. It makes men of sterling qualities and establishes confidence, and these all become part of the bone and tissue of the body, making an organization self-sustaining and equal to the constantly growing demands. The other conditions will not accomplish this; they breed irritation, distrust, discontent, and kill that voluntary loyal effort that counts far more than anything else in a large organization. . . . I know of one railroad shop that can boast of having produced more foremen, master mechanics and superintendents of motive power than all of the other shops together of the same railroad, which is a very large one and has many shops. What was the reason for it? The man in charge knew how to maintain an organization. He knew how to select; he knew how to develop and make responsible, and he knew how to discipline, and those that grew up under him knew how to do these things also. He took a lively interest in this question; he got the best results for the railroad, and when he got through it was a great satisfaction to him to feel that he had developed good men. There can be no greater satisfaction to a man than this. . . . How can one be expected to bear responsiblity if he does not have the opportunity to try? How can one have good judgment if he is not permitted to judge? How can one make proper use of authority if he does not have it constantly enough to learn by experience? . . . It is much easier to keep authority to oneself than to delegate it, but as responsibility cannot all be assumed by any one head, so must authority be delegated. This, therefore, seems to be the underlying principle of organization, and it thus becomes a most important duty in all large organizations to apply it to the fullest possible extent. Auxiliary to this principle is the one having duties or responsibilities well defined. . . .

There is hardly any other work that contains so much of emergency as the railroad service, and because of the separation, often by long distances, of executives in the same department, it is specially important that an officer on the ground confronted with an emergency shall have sufficient initiative to act promptly, even at the risk of making some minor mistakes. This suggests the necessity and duty of having subordinate heads qualified for their positions. It sometimes happens that a man not having the necessary qualifications holds an executive position, and there is often an inclination to continue

*From a paper by Mr. S. P. Bush, read before the Western Railway Club, September, 1901.

such a condition longer than one's better judgment dictates. . . . The selection of a suitable man for a position is a matter that is constantly arising, and often the right one does not appear to be at hand. Whenever this is the case it is evidence that an important duty has been neglected. . . . Think of having several hundred or even thousand men in a department and none at hand for a position. . . . The master mechanic of the shop which turned out so many men that afterward came to executive positions is one who did give this matter most careful attention and he got the results. When you consider an organization of a thousand or two thousand men, it seems absurd for the head of a department to say that he has not got men. There are plenty of men there; if they are sought out, if the proper influence is exerted, they will come out, but it is terribly neglected. . . . How are we to operate progressively and economically? All that may be supplied in the way of facilities and equipment will avail but little without men to properly direct their use. A cheap executive is neither progressive nor economical. . . . When minds are at work on problems they are sure to produce results and when they are not they produce nothing. To establish the condition of active thought is one of the highest duties of executives, and the higher the position the greater the duty. It means leadership and breadth as against mere supervision and keeping everything to oneself.

Among organizations as large as are often found in the railroad mechanical departments it would seem that enthusiastic and loyal effort must be a most important factor. But surely the moving spirit in bringing about such a condition, like water, cannot be expected to run from a lower level to a higher one; it must start from the higher level. This is the problem that we generally call the "handling of men." We are confronted to-day in this matter with a set of conditions entirely different in many respects from those existing some years ago. The number of employees coming under one organization growing larger and larger, a growing tendency to centralize authority, the organization of labor not only local but national, and a strong influence in some cases towards separation of interests between executive heads and other employees are conditions we have to meet. . . .

I would ask you why it is that one man is selected from among a number to direct or command? For one reason, and only one, viz., because he has greater intelligence; because he knows more and is a greater force. It is a mistake to elect or select on any other grounds. This is the fundamental law of all organization and government. Allowing this we come now to the root of many of our troubles, and especially when wide differences of opinion prevail.

There is the intensely practical and commercial view that all men are so many machines, forming one great machine in an organization, to the end that locomotives and cars may be constructed and repaired, with no other responsibility. I see no reason to criticise a smooth, machine-like running organization—in fact, it is desirable; but I believe that there are other responsibilities than the mere turning out of product. The moral responsibility of everyone is as great and as constant whether one is here or there, or doing one thing or another, and this responsibility is in exact proportion to the intelligence of the individual. Therefore, if one occupies a position as a result of superior intelligence, it is hardly sufficient that it should carry with it greater skill or mere supervision of work alone. The greater intelligence must carry with it in a higher degree all the attributes that go to make a better manhood, including better judgment and greater justice. Greater intelligence is bound to enlighten, within the bounds of propriety, the lesser intelligence. It implies leadership and teaching, not in some things, to be sure, but in all of the relations that bring individuals together in industry and business. Of what service can greater intelligence be if not by an appeal to the reason to teach? Why then should executives stand aside and allow the man of intemperate thought, without full information as to the true status of affairs, put wrong ideas and impulses into the minds of employees?

I hear someone say this is a very fine theory, but it won't work. It would be most interesting to have this individual tell us what is wrong with it and what will work. Many of you here can think of cases where it has worked and where it does work. It is a good deal of an undertaking to say that men are not susceptible to reason and better impulses, and that they must learn always through chastisement and their own mistakes. I have had a good many conversations with men on this subject and many of them say, "This is a very fine theory, but it won't work;" but I have never heard one of them present a plan that will work, and these are the men that get along for a while, but they break in time. . . .

I would like to have any one point out how anything of lasting value was ever accomplished except by intelligence and better impulses, and so I say it is a most important duty of executives to consider that their responsibility does not end with the production of engines and cars, but in the management of men, by their own actions, and their greater intelligence to exert an influence that will tend to better understanding, confidence and harmonious work, to the end that the organization may be maintained.

I contend that voluntary effort and activity as against indifference or compelled action is a necessary element for satisfactory operation. To be sure necessity compels men to work; but there is a vast difference between doing as little as one can or as much as one can, or between helping along and holding back, and whether it is one thing or the other depends finally upon the executives.

## Foreign Railroad Notes.

That Russia's relations with the civilized world are becoming more intimate is suggested by the fact in Bromberg and Danzic the Prussian State Railroads have established seminaries for teaching railroad employees the Russian language. Men of several different ranks and classes in the service selected for this acquirement will be excused from duty for 9½ months to enable them to follow the instruction in these seminaries.

The Berlin-Naples limited express will not begin running until Jan. 16. Passengers will pay for first-class tickets, and in addition about ⅞ cent per mile, which will go to the International Sleeping Car Co. Custom-house inspection of baggage will be made on the train. Europe is beginning to be civilized.

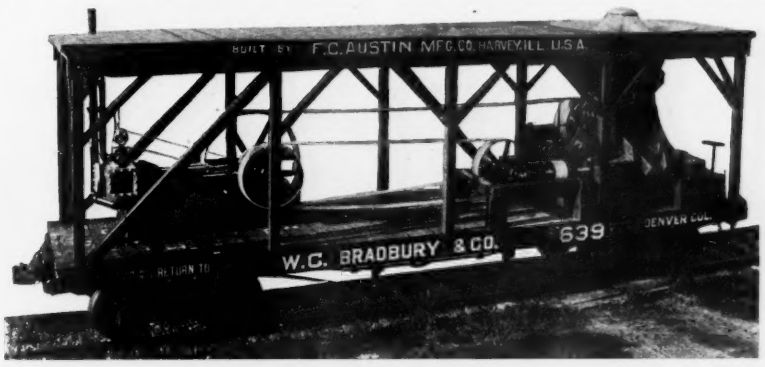
The Vienna house of Siemens & Halske claims to have devised a signal light which can be seen in a fog. It substitutes for one great light high above the track a series of lights, level with the engineman's eye and as close as possible to the track.

During the past summer an electric railroad has been completed to the foot of Mount Blanc at Chamounix, which makes it possible to reach that place from Geneva in 3¾ hours. But recently the journey was by diligence and took the greater part of a day.

## A Traveling Stone-Breaker.

The F. C. Austin Manufacturing Company has devised and built a portable stone-breaking plant, which is shown in the engraving herewith, from a photograph. This was built for W. C. Bradbury, of Denver, a well-known contractor in the West. The plant will be first put into the service of the Colorado Fuel & Iron Company, at Bessemer, Colo., to turn out broken slag and limestone ballast and later will be sent into regular railroad work.

It consists of a No. 5 Austin gyratory crusher with horizontal engine, all mounted on a standard flat car and so arranged that the elevator which takes the discharge from the crusher may be hung from the side of the car carrying the broken stone to the screen and storage bins established alongside the plant. These latter are best arranged so that the graded stone may be discharged directly into the ballast cars for distribution. Obviously, a tramway may first be advantageously built on the side of the cut level with the top of the car and so arranged as to run the stone from the quarry to the breaker by gravity. The hopper of the breaker, it will be observed, is flush with the car roof. A pair of horizontal boilers large enough to provide steam for the breaker and rock drills is conveniently carried on a separate flat car.




A Traveling Stone-Breaker.

Obviously, an arrangement of this sort might be useful on many railroads where stone suitable for ballast is found distributed over a considerable length of line and where quarries are situated at points where there is no local market for broken stone. In cases of this class it is quite obvious that a portable stone-breaking plant would be found economical and convenient.

## The Fulton Yard of the Chesapeake & Ohio.

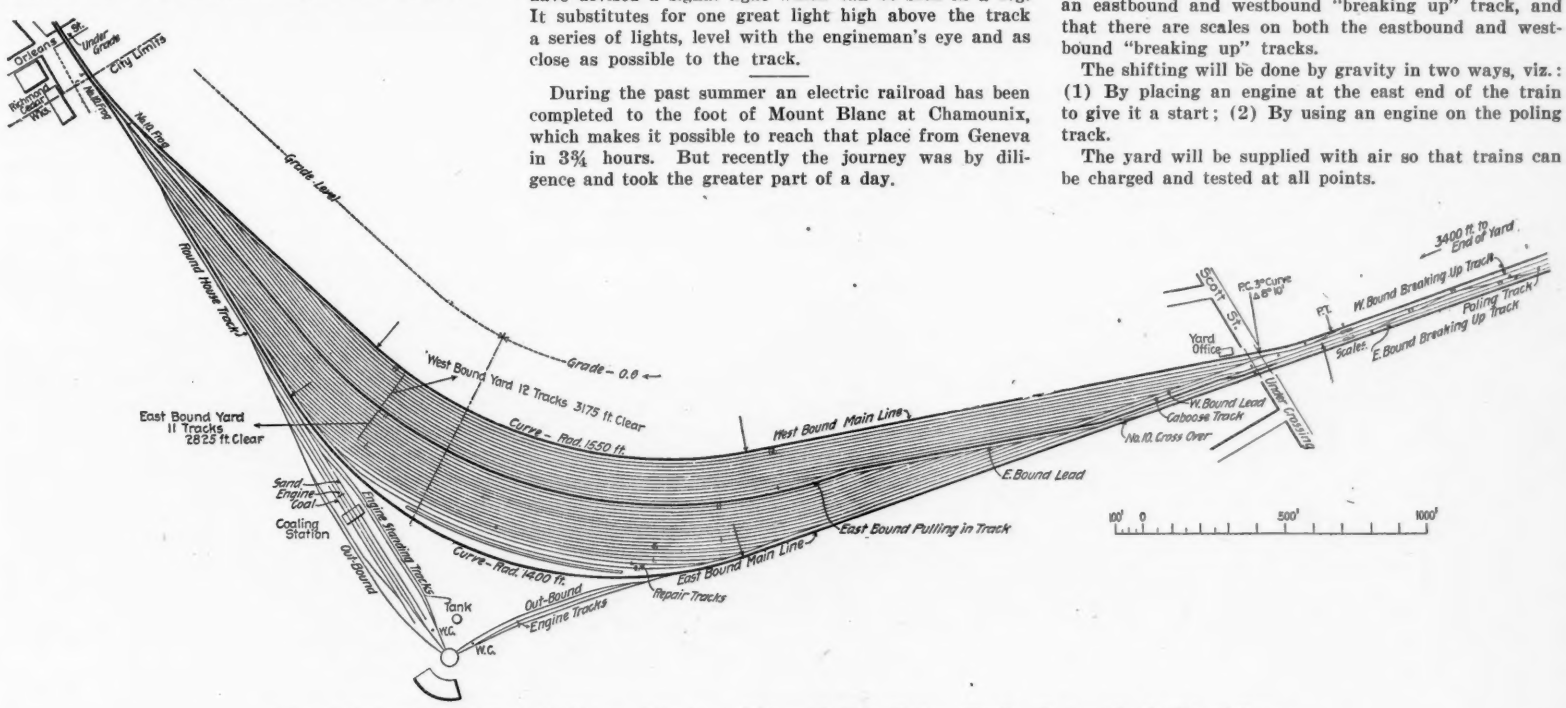
The engraving shows the new yard of the Chesapeake & Ohio east of Orleans street, in Richmond. In the westbound yard there are 12 tracks; each track, 3,175 ft. in clear. In the eastbound yard there are 11 tracks; each track 2,825 ft. in clear. In addition, there are five short tracks in the eastbound yard for local use. The main tracks are on each side of the yard.

Eastbound trains pull in at the west end of the yard on the eastbound "pulling in" track, and are pulled through the yard to the eastbound "breaking up" track. Westbound trains enter at the east end of the yard, either on the westbound "breaking up" track or at the cross-over at the scales. When a train enters at the latter point it pulls into the westbound yard, and, if it has to be switched, the yard engine pulls it back on the westbound "breaking up" track.

It will be observed that there is a poling track and an eastbound and westbound "breaking up" track, and that there are scales on both the eastbound and westbound "breaking up" tracks.

The shifting will be done by gravity in two ways, viz.: (1) By placing an engine at the east end of the train to give it a start; (2) By using an engine on the poling track.

The yard will be supplied with air so that trains can be charged and tested at all points.




Plan of Proposed Yard East of Orleans Street, at Richmond, Va. (Fulton Yard), Chesapeake & Ohio Railway.

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.
PUBLISHED EVERY FRIDAY
At 32 Park Place, New York.

## EDITORIAL ANNOUNCEMENTS.

*CONTRIBUTIONS—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussion of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

*ADVERTISEMENTS—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

On Monday of this week a committee representing the Trunk Line Association, the Central Traffic Association and the Western Passenger Association met in New York City to confer upon the matter of taking steps to greatly reduce the number of passes issued. It is reported that this committee voted to recommend the complete abolition of free passes, to take effect Jan. 1, 1902. It is to be hoped that this proposition will be carried into effect. It is not necessary for us to go now into the merits of a matter which we have so frequently discussed, but everybody must recognize that the arguments against the issue of passes immensely outweigh the arguments for. If ever there was a time when such a movement could be inaugurated with hope of success it is the present, when control has become centralized and when the railroads are prosperous. We notice that one of the presidents who attended the meeting is reported to have said that "this is the only country in which the pass system prevails." The accuracy of this statement will probably turn on the meaning of the word "prevail." We have the best of reasons to know that on the railroads of England passes are sometimes issued, although doubtless not nearly so often as in this country. We do not know, however, what the practice is on the Continent of Europe.

We ask attention to a paper published by abstract in another column, presented by Mr. S. P. Bush before the Western Railway Club at its September meeting. Mr. Bush in this paper calls attention to a neglected duty of mechanical officers, and indeed of all officers in responsible place. This is the duty of providing for the stability and growth of the personnel. There are but few railroads in the United States where systematic effort is made to have selected young men in training for the succession in all departments. Usually whatever work is done along this line is isolated and fragmentary. Here and there will be found a superintendent of motive power or a division superintendent or a division engineer, or some other officer, who, from a broad sense of duty or from a sympathetic interest in the men under him, tries more or less systematically and persistently to train them for higher responsibilities. Ordinarily, however, matters are allowed to drift. The results of these conditions are pointed out in Mr. Bush's paper, and we would advise all railroad officers to read it, for the principles apply to every other department as well as to the mechanical department. We have taken space to print only a comparatively small part of the paper, but it will shortly be available in full in the Proceedings of the Club.

Our eighth semi-annual Construction Supplement of new railroad and bridge work in the United States, Canada and Mexico accompanies this issue of the *Railroad Gazette*. This Construction Supplement contains a list of new railroads and also of extensions and important improvements of old lines either building or proposed. An evidence of the extent of railroad activity is shown in the fact that nearly 1,700 such entries appear in this Supplement, representing about 1,100 different railroad companies. Attempt is made to show the present status of each project and to indicate the fact plainly wherever work is in progress. So far as can be learned, names and addresses are given of operating officers of the newer companies and also of contractors, where contracts have been let. The Supplement also contains a list of important railroad and other bridges, on which contracts, so far as known, are yet to be let. About 1,200 such bridges are included, and the field, as in railroad building, covers practically the entire North American Continent. The Construction Supplement is not simply a summing up of material that has from time to time appeared in the columns of the *Railroad Gazette;* it contains a large amount of information supplied by letters from railroad officers and from other official sources and now for the first time made public. Extreme care has been taken to make the Supplement as complete, accurate and up-to-date as possible in every particular.

### The Engineer Committee on Rail Sections.

We venture once more to call the attention of members of the American Society of Civil Engineers to the fact that on the proposition to appoint a committee on rail sections not enough votes have been received to permit them to be canvassed. Concerning the importance of this committee we wrote at considerable length August 23, and mention the matter now merely to again call attention to its importance.

The proposition (in very general terms) is to have a committee appointed which shall consider whether or not it is desirable to make any revision of the standard sections of the Society and to suggest the modifications, if any are to be made. Obviously, it is objected that we have hardly got these sections into use and that a proposition to revise them comes a little too soon. This is an unscientific, not to say timid, point of view. The reasonable course would be to face the matter and to really ascertain whether or not a revision of the section is desirable.

Reluctant as we are to say a word that would tend to throw open again the question of a standard rail section, yet we feel pretty confident that the question will speedily be thrown open by somebody. If that is true the American Society of Civil Engineers ought to take the lead in the revision. Probably about 70 per cent. of the product of the rail mills to-day is rolled to the Society's standard sections, and these sections are, beyond doubt, the best in the world for flange rails. It does not follow, however, that they cannot be improved or that they will not be improved.

A new condition which has arisen since the committee decided on these sections is destined to be a controlling condition; that is, the determined effort to have rails finished at lower temperature than heretofore. Just how this will be brought about is immaterial at this moment. The important point is that it will be brought about. But one of the difficulties in the way of this improvement is the fact that the thin flange of the American Society section parts with its heat so rapidly that it is difficult to work the rail at the low temperature which is desirable. In other words, when the flange has become too cool to work the head is not cool enough to get the results which are sought. This is the technical part of the matter in a very small nutshell.

Another aspect of the question is that it is due to the prestige and dignity of the Society to retain the lead in this important matter. The Society did not take enough interest in the rail joint matter a year or two ago to vote for a committee to consider that subject. It would be unfortunate should it not take enough interest now to vote for a committee on the revision of the rail section. We estimated when writing before on this subject that 20 or 25 per cent. of the membership of the Society get their living directly from the railroads. This was from a rough count of the list of members. Of course, a very considerable number beyond that get their living indirectly from the railroads through work on bridges and buildings and in the various branches of manufacture of machinery, cements and other material. We take it, therefore, that the Society has still enough interest in railroads to try to keep the lead which it has long held in railroad engineering.

### Hand, Lamp and Oral Signals.

What the reporters don't get hold of nowadays isn't worth much notice. A recent item of local interest which has served as the text of "specials" to half-a-dozen great dailies is that concerning the dangers of using "Pennsylvania Dutch" in carrying on yard switching. As told in a letter printed by us a few weeks ago, the Lehigh Valley has had to remind its freight trainmen at Allentown to "speak United States," for a conductor gave an order in the local jargon and a brakeman whose linguistic accompaniments were somewhat deficient misunderstood it and smashed a few drawbars by running some cars on to the wrong track. But though it seems absurd for a newspaper to spend money to lay such a trifling matter before the whole reading world, we confess that for ourselves—that is, for the railroad world—we look upon the incident as one of general interest; not because Pennsylvania Dutch—or any other dialect of spoken words—is likely to make trouble anywhere else, but because it is typical of irregularities similar in principle but different in detail which *are* to be found at many places and for which the remedy is practically the same as that for the case at Allentown, to wit: a uniform enforcement of the regulations of the standard code which should govern the use of hand, lamp and oral signals in moving trains or engines. And it takes but a brief examination of the actual practice to show that the code itself needs improvement. In short, there should be a better code, more closely adapted to the needs of the work; and a better enforcement of the code, whether we do or do not improve it.

The chief irregularity which we have in mind is the use of unauthorized hand-motions and the slovenly execution of those which do have some semblance of being the regular signals.

To do switching expeditiously it is necessary to have a code of hand signals considerably more extensive than the brief one published by the American Railway Association and by most railroads; and the question has occurred to many who have looked into the matter, Why does not the Association agree upon and approve hand signals for "Ease ahead," "Ease back," "Cut off engine," "Back up to couple" (that is, back up a limited distance, the limit being indicated), "Head in on side track," and other movements which are common? A recent issue of a railroad paper contained a letter from Kansas City telling of conditions that had been observed on a Western road. This letter says:

> "It seems strange that one source of petty delays, and damage to cars and lading, which cannot be classed as resulting from accident, is almost entirely overlooked. I refer to the lack of uniform signals by hand and lamp from trainmen to enginemen, and the lack of judgment in giving signals. Many drawbars are broken, draft timbers pulled out, cars and freight damaged, and delays caused, by this lack of system in signals. I have been employed by several different railroads in the transportation department and find this matter almost entirely overlooked by all.
>
> "Looking over the book of rules, both standard and others, we find under hand and lamp signals, 'Go ahead,' 'Back up,' 'Stop' and 'Broken-in-two.' This is the extent of the printed rules. Experienced railroad men have added and handed down, independent of a ritual, various other signals, such as, 'To open street crossings,' 'Head in siding,' 'Back in siding,' 'Cut off engine or cars,' 'Kick cars,' 'Reduce speed,' 'Car length,' different tracks and others too numerous to mention. In fact, a crew of good brakemen and enginemen who work together for some time have this system of signs so perfect that it is surprising how speedily and safely they handle their train, and this in a way which would be impossible with only the printed signals to work by."

The writer goes on to recount the circumstances of observed cases where much time was wasted by lack of intelligent co-operation between conductor, engineman and brakeman. This inefficiency was due to poor training in those hand motions which are satisfactory, as well as to lack of signals to indicate certain things; indicating that we need not only to supply deficiencies in the code and to educate the men in necessary new habits, but to correct their performance of duties which are supposed to be already understood.

It is quite true that few if any serious accidents result from errors of the kind we are speaking of, or from lack of a sufficient variety of motion or oral signals. If a bit of a collision occurs because a brakeman is unable to quickly convey an idea to the engineman the cause is attributed to something else, and usually this explanation is partly right; but often is not wholly so. Switching can be carried on successfully with a home-made code, as the above-quoted writer observes, but that does not indicate that a uniform code is unnecessary; rather it is a reminder that such home-made codes ought to be made uniform. The argument that signal codes should be the same on all roads in order that trainmen leaving one road and going to work for another need not learn new habits

is not, in our opinion, very important, or it should not be; for each road should have its forces so well organized that new men can be taken on from the farms, when needed; and so that new men from other roads, if taken, shall be a very small percentage of the whole force. But uniformity of signal codes is a desideratum for other reasons; because the running of the trains of one company over the lines of another is likely to increase rather than decrease, and because every crew ought to have the best possible code. Unless all the unofficial codes are of precisely equal merit, there must be some features of some of them which ought to be abandoned in favor of better features, to be learned elsewhere.

We do not write for the purpose of proposing a supplementary code. To make even the first draft of a switching code would be a work such as only a representative committee could adequately deal with. It would demand both good judgment and experience, as well as a knowledge of just what the habits of the yardmen in different parts of the country now are. Neither do we assert or suggest that the proposed improvement in the service would be in the nature of an improvement of the standard code of the American Railway Association; for the tendency of that code is now against rather than in favor of uniformity, except in a limited number of essentials. The last revision of this work indicates that the most popular code is the one which prescribes uniformity in the smallest number of things. But the difficulty of agreeing on uniform train rules in a conservative body like the American Railway Association, composed of men whose minds are largely taken up with other matters, is not a good reason for abandoning all effort in that direction. The meetings of the A. R. A. are not of the right character to foster discussions of this kind.

The need of improvement in making motion signals, as distinguished from the question of having a greater variety of signals, is as apparent in the passenger train service on the road as among switching crews. The go-ahead motion for daylight use is so unsatisfactory that many trainmen apparently do not try to use it, while others make it in the clumsiest manner imaginable. But it is tolerable because by use of the voice the need of a good motion is minimized, or because even a misunderstanding usually does no harm. But why not have a thoroughly suitable signal? Why retain a poor day signal simply for the purpose of being able to say that it is uniform with the night signal? The day motion signal for "stop" is, if possible, less suitable for its object than the go-ahead.

The codes in use in England and Australia are not without their suggestions in this line. We do not think that the principal motion signals used in those countries would be liked in this country so well as motions that could be selected from (unauthorized) practice already prevailing on many American roads; but the variety to be found in the English codes is instructive, and some of their rules might suggest to us what *not* to do. The use in England of colored hand lamps, motionless, instead of white lanterns to be moved, may be worth looking into. The need of colored hand lamps to take the place of motion signals has never been much felt in this country, so far as we are aware; but if green becomes the general go-ahead night color for semaphores, it may be desirable to make some changes in the signals that are used nearer the ground, including those on engines and cabooses.

## Annual Reports.

*New York Central & Hudson River.*—The annual report of this company for the June 30 fiscal year shows practically stationary traffic, considering the great total of the figures, but there is continued gain in earnings, which gain has been very heavy in previous years. Total revenue ran up to the great figure of $66,633,111 for all the lines now directly operated by the New York Central, that is, the system of 3,223 miles, with Buffalo as its western limit, and Boston as its eastern terminus. In passing it may be noted that the Pennsylvania Railroad, for its directly operated lines East of Pittsburgh and Erie in its last fiscal year, ending Dec. 31, 1900, reported gross earnings of $88,540,000 on 3,733 miles of road. This, however, was without including important controlled lines like the Baltimore & Potomac, the Philadelphia, Wilmington & Baltimore, which another year will probably be included in the returns, as the company has now offered to buy the shares now held by the public, or to exchange their stocks for its own shares.

New York Central's gross revenue of $66,333,111 shows an increase of $11,770,000 over the preceding year. These figures include the operations of the Boston & Albany, which are separately reported in the Central's statement, their gross earnings last year being given as $9,931,400. Excluding their revenues New York Central's actual increase in gross receipts last year was $1,838,763, or 3.4 per cent.

The report contains two income statements for 1901, one including the Boston & Albany, the other excluding its returns. Both of these are given below, together with the statement of 1900, which compares with the second of the income accounts for 1901.

| | 1901. | 1901. | 1900. |
|---|---|---|---|
| Average miles | 3,223 | 2,828 | 2,817 |
| Freight earnings | $39,550,399 | $34,810,513 | $34,273,141 |
| Passenger earnings | 20,866,356 | 16,738,344 | 15,464,293 |
| Express | 1,714,615 | 1,449,736 | 1,401,937 |
| Mails | 2,046,000 | 1,695,374 | 1,698,450 |
| Total earnings | $66,333,111 | $56,401,724 | $54,562,951 |
| Expenses | 42,588,216 | 36,162,654 | 34,051,587 |
| Per cent. expenses | 64.2 | 64.1 | 62.4 |
| Net from operation | $23,744,895 | $20,239,070 | $20,511,366 |
| Gross income | 28,275,189 | 24,754,434 | 25,228,110 |
| Charges | 20,233,005 | 16,918,553 | 16,949,083 |
| Sinking fund | 300,000 | 300,000 | 300,000 |
| Profits | $7,742,183 | $7,535,881 | $7,979,027 |
| Dividends | 5,750,000 | 5,750,000 | 4,937,500 |
| Surplus | $1,992,183 | $1,785,881 | $3,041,527 |
| Improvements | 1,500,000 | ..... | ..... |
| Balance | $492,183 | ..... | ..... |

Gross traffic earnings, operating expenses, and balance over charges for a series of years, with average operated mileage, are shown below:

| | Miles oper. | Gross earnings. | Operating expenses. | Profit. |
|---|---|---|---|---|
| 1892 | 2,266 | $46,175,663 | $30,504,226 | $4,589,177 |
| 1893 | 2,278 | 47,796,007 | 31,342,328 | 4,785,717 |
| 1894 | 2,589 | 44,229,607 | 28,874,837 | 3,565,888 |
| 1895 | 2,575 | 43,231,849 | 28,069,951 | 3,161,873 |
| 1896 | 2,577 | 46,027,197 | 29,510,266 | 4,176,746 |
| 1897 | 2,585 | 45,199,465 | 28,386,771 | 4,174,892 |
| 1898 | 2,585 | 47,484,632 | 30,391,882 | 4,843,633 |
| 1899 | 2,828 | 48,124,015 | 30,171,156 | 5,687,875 |

Percentage earned on stock in each of these years was as follows:

| | Per cent. | | Per cent. |
|---|---|---|---|
| 1892 | 5.13 | 1897 | 4.17 |
| 1893 | 5.35 | 1898 | 4.84 |
| 1894 | 3.78 | 1899 | 5.69 |
| 1895 | 3.16 | 1900 | 7.77 |
| 1896 | 4.18 | 1901 | 6.73 |

Expansion of passenger revenues was a large factor in raising New York Central's gross receipts last year. Increase in passenger revenues was $1,274,000, or 8.2 per cent. over 1900. These figures exclude the Boston & Albany operations as do all the figures and comparisons which we shall have occasion to refer to in this review, unless the contrary is specifically stated. This gain follows large expansion in previous years, the 1901 figure being 20⅔ per cent. over those of 1899. The directors point out that the increase last year was "not attributable to any one especial cause, as, for example, the opening of the Pan-American Exposition in May and June, but has been well distributed throughout the entire 12 months."

Last year passenger income contributed 69 per cent. of the total increase in gross, and most of the gain was in local business, which gained 62¼ per cent. New York Central's passenger revenues per mile of road, $7,111, are now considerably beyond the total gross receipts per mile of such substantial properties in the West as the St. Paul, the Atchison, the Rock Island, the Burlington, etc.

While passenger receipts show great development in recent years, changes in freight last year were not so gratifying, though by no means unfavorable. With an increase in average ton-mile rate from 5.6 mills to 5.8 mills freight revenues show a gain of over $537,000, or 1⅔ per cent., and of $5,530,000, or 19 per cent., over 1899. Earnings per mile of road on freight ran up to $12,305, about 1 per cent. more than last year, and $1,840, or 17.4 per cent. over the receipts per mile in 1898. The decrease in freight movement appears to have been due to a diminution in through tonnage. Where there was a loss of 182,658 tons in the year, the change in way freight being less than 1,000 tons in a total of over 33⅔ millions.

Tons one mile were reduced by over 81 millions to a total of 6,036½ millions, but this decline was only 1⅓ per cent. on the revenue traffic. It was more than compensated for in final revenue results, by the gain of 2⅔ per cent. in the ton-mile rate. Larger relative increase in freight train-mile earnings indicates that further economy was developed in handling train-mileage despite the decreased movement in ton-mileage which must have been largest on traffic where the heaviest train loads are obtained. While the ton-miles diminished 1⅓ per cent. the freight train-miles were reduced 2.4 per cent., to 16.2 millions, and the earnings per freight train-mile rose from $2.03 to $2.11. The average trainload of revenue freight was 367 tons and the year before it was 363 tons. The average trainload, including company's freight, was 411 tons.

The Directors point out that the increase in freight revenue last year was largely due to improvement in the conditions governing the company's coal traffic, but this must refer to rates, rather than to actual expansion of tons moved. Thus soft coal tonnage shows a loss of 589,000 tons last year on what have been referred to as the New York Central's lines proper, and the total coal tonnage moved on all lines was smaller in 1901 than on the 400 miles less road in 1900. But for the heavy decrease in bituminous coal, actual tons moved would have shown an increase of over 400,000 tons, and the changes of individual classes of freight confirm the statement of the Directors that a marked feature of the year's traffic was the improvement in tonnage in the relatively high class freights.

The company, in 1901, established a fund of $1,500,000, by a charge against surplus income, against which charges for betterment work will be made, instead of against expenses. This explains a decrease in maintenance of way expenditures in 1901. These for the last three years, excluding the Boston & Albany, have been as follows:

| | 1901. | 1900. | 1899. |
|---|---|---|---|
| Miles operated | 2,829 | 2,817 | * |
| Maintenance way | $6,710,192 | $7,190,285 | $4,971,777 |
| Maintenance equip | 6,718,145 | 5,598,092 | 5,276,975 |
| Cond. transp | 21,410,525 | 19,906,225 | 18,728,548 |
| General expenses | 1,323,782 | 1,356,984 | 1,193,857 |
| Total | $36,162,644 | $34,051,586 | $30,171,157 |

*2,585 miles to April 30; 2,829 from May 1.

The percentages of each class of expenses to gross earnings for four years past are shown in the following computation, which brings out well enough the decreasing proportion of transportation cost, to receipts. The figures follow:

| | 1901. | 1900. | 1899. | 1898. |
|---|---|---|---|---|
| Maintenance way | 11.90 | 13.18 | 10.33 | 10.31 |
| Maintenance equip | 11.91 | 10.26 | 10.96 | 10.89 |
| Cond. transp | 37.96 | 36.48 | 38.92 | 40.34 |
| General expenses | 2.35 | 2.49 | 2.48 | 2.46 |
| Total | 64.12% | 62.41% | 62.69% | 64.00% |

As regards the increase of 1½ million dollars in aggregate transportation expenses last year, it appears that the largest item was for locomotive fuel, or $562,350, while wages of enginemen and roundhousemen increased $299,000, and $235,000 for wages of station force and trainmen. These items are in part due to higher rates of pay, in the one case, and higher price of coal in the other, but increasing business was also a factor. Engine mileage was 2,309 miles more than in 1900. The report notes that these increases were in part offset by a saving of $306,000, or 53 per cent. in balances paid to other companies for car hire, a saving attributed by the recent additions to equipment.

Changes in capital account last year included issue of $5,000,000 3½ per cent. bonds on account of purchase of Boston & Albany property, not included in the lease. Other bonds were issued in refunding operations, and although the total increase in bonded debt was $8,021,000, fixed charges were less in the year by $30,530. Direct saving by refunding high rate bonds is placed at $538,600 last year, and at $1,686,400 since the inauguration of the plan in July, 1897. A noteworthy change in the balance sheet is the disappearance of $6,461,037 carried in the 1900 balance sheet as loans and bills payable. Current liabilities increased $571,000, against the $1,308,000 gain shown in current assets. The latter show an excess of $1,202,000 over current liabilities.

*Chicago & Alton Railway Co.*—This new company issues a first report, covering the operations in 1901 and 1900 of a very old property, the Chicago & Alton Railroad, one of the oldest and best known of the so-called Chicago granger railroads. Certain additional lines have been added to the old Alton road. The report opens with an historical account of the various railroads making up the mileage now operated. This bare record may be supplemented with a reference which probably would not have been proper in the report itself, to the circumstances and means which gave this company control of the Chicago & Alton R. R. When the old Alton road completed its connections with St. Louis and Kansas City its managers considered the property complete and resolutely held aloof from the mania for extension in the late eighties, which, in 1887, added nearly 13,000 miles of new railroad in the United States in one year. Later, when the companies which had been concerned most largely in extending their lines, some of them adding 2,000 miles in a year, fell into financial difficulties, the Atchison and the Union Pacific going into bankruptcy; the Missouri Pacific, saved only by personal advances of its directors; the St. Paul, the North Western, the Burlington and others suspending or reducing dividends, the Alton continued uninterruptedly its 8 per cent. dividends on its common and preferred shares.

Earnings, however, did not improve to any great extent in the revival of business following 1896, so that in 1899 gross revenues were less than in 1893, 1892 and a long number of earlier years. Net revenues showed a still less favorable record, as will be seen on the following comparisons in gross and net revenues of the old Alton, operating 843 miles of road.

| | Gross earnings. | Operating expenses. | Net earnings. |
|---|---|---|---|
| 1899 | $7,155,960 | $4,163,600 | $2,982,380 |
| 1898 | 6,286,570 | 3,869,800 | 2,416,770 |
| 1897 | 6,673,600 | 4,153,680 | 2,519,920 |
| 1896 | 6,840,280 | 4,038,550 | 2,810,730 |
| 1895 | 6,802,490 | 3,983,000 | 2,819,490 |
| 1893 | 7,566,640 | 4,665,890 | 2,910,750 |
| 1891 | 7,590,880 | 4,458,750 | 3,132,130 |
| 1888 | 7,511,460 | 4,668,090 | 2,843,370 |
| 1885 | 7,993,170 | 4,612,850 | 3,380,320 |
| 1882 | 8,215,500 | 4,684,500 | 3,351,000 |

Mileage was unchanged at 843 miles in all years since 1888, and, according to Poor, was 549 miles in 1885 and 399 miles in 1882.

Dividends were reduced to 7 per cent. on the two classes of stock, in June, 1897, when neighboring roads were reporting heavy gains in income, and enlarging dividend disbursements. Alton, in fact, found that many companies on which it formerly depended for traffic, had their own lines extending into or beyond its territory, and that its neighbors, with their through lines, were drawing traffic which it had formerly obtained. About this period, when the management was struggling with the problem of holding its traffic, certain New York financiers, the more important of them being the American representatives of European financial concerns, bought up a local railroad in Southern Illinois, which had been several times bankrupt and was of little consequence.

They proposed, however, by northerly and southerly extensions to complete a new through line between St. Louis and Chicago. They had in view, for one thing, to secure a new tenant for the Chicago Terminal Transfer Company's station in Chicago, then as now, not used to its full capacity. In this property they were heavily interested financially. The new line, if built, would have paralleled and hurt the Alton, and the project seriously disturbed the management and security holders at a time when other difficulties surrounded the property.

Finally, however, other New York banking interests bought up the local line and got the opportunity to secure a controlling interest in the Chicago & Alton itself. To complete their control they offered the old shareholders, in April, 1899, $200 per share for the preferred and $175 per share for the common stock. Most of the stockholders agreed to this, and the purchasing syndicate then organized the Chicago & Alton Railway, leased the Chicago & Alton Railroad and bought 57 miles of St. Louis, Peoria & Northern, whose construction and extension plans had brought the Alton to the particular notice of the New York bankers. It is unnecessary to go into the financing of the old railroad and how its surplus was divided up in special dividends of 30 per cent., the capitalized book value of its property increased and so on, further than to note issue of $32,000,000 3 per cent. refunding bonds, etc.

The leasing company issued $22,000,000 of 3½ per cent. bonds also, and $40,000,000 new shares, equally divided between preferred and common. It owns practically all the $22,000,000 stock of the old Alton and receives dividends thereon.

It is this company then which is virtually the present operating Alton property. Its present report shows heavily increased earnings and enlargement of traffic, greater in the last year than shown in many years by the old property. The report is virtually for 18 months, as the last previous report covered the 12 months to Dec. 31, 1899. Comparisons, however, are made for the two fiscal years ending June 30, and these show that gross earnings increased by $1,240,206, or 16 per cent., in 1901, of which freight revenue accounts for $952,100, or 19 per cent. increase, and passenger revenue for $277,160, or 12 per cent. increase. Expenses, however, increased in the aggregate by $1,055,000, or 23¼ per cent., so that the gain after taxes was reduced to 5 per cent. The figures of the income account follow:

| | 1901. | 1900. | Increase. |
|---|---|---|---|
| Miles | 920 | 855 | 65 |
| Gross earnings | $9,036,656 | $7,796,450 | $1,240,206 |
| Expenses: | | | |
| Maintenance of way | 1,109,514 | 881,575 | 227,938 |
| Maintenance of equip. | 879,412 | 613,405 | 266,007 |
| Cond. transportation | 3,384,637 | 2,835,576 | 549,061 |
| General expenses | 222,105 | 210,562 | 11,544 |
| Total | $5,595,668 | $4,541,118 | $1,054,550 |
| Taxes | 330,427 | 290,703 | 39,724 |
| Net earnings | 3,110,560 | 2,964,628 | 145,932 |
| Per cent. exp. and taxes. | 65.58 | 61.95 | 3.63 |
| Income from investm't. | 1,531,381 | ..... | ..... |
| Net income | $4,641,941 | ..... | ..... |
| Lease rentals | 3,023,033 | ..... | ..... |
| Int. 3½ per cent. bonds | 770,000 | ..... | ..... |
| All charges | $3,793,033 | ..... | ..... |
| 4 per cent. pref. div. | 781,760 | ..... | ..... |
| Surplus | $67,148 | ..... | ..... |

The large income from investments is explained by the dividends on Chicago & Alton Railroad stock held by the company, 7 per cent. on each class of shares.

Certain items of the income per mile follow:

| | | | | |
|---|---|---|---|---|
| Freight earnings | $6,474 | $5,439 | Inc. | $1,035 |
| Passenger earnings | 2,798 | 2,497 | Inc. | 301 |
| Gross earnings | 9,826 | 9,118 | Inc. | 708 |
| Expenses and taxes | 6,444 | 5,651 | Inc. | 793 |
| Net earnings | $3,382 | $3,467 | Dec. | $85 |

These earnings are on ton-mile rates of 7.23 mills and passenger mile rates of 1.94 cents, the latter a little better than in 1900, the former decreasing from 7.94 mills in the previous year, but both figures being less than the averages reported by neighboring roads, although the Alton's traffic is so largely local. The decrease in ton-mile rate is accounted for in the report as due to the large increase in low-class freight, especially coal. The 19 per cent. increase in freight revenues, by increases of 21 per cent. in grain, of 32 per cent. in all agricultural products, of 45 per cent. in coal, and minerals, of 56 per cent. in lumber and of 28 per cent. in manufactures.

Density of passenger and freight movement on the Alton exceeds that of neighboring roads, ton-miles per mile being 965,300, and passenger-miles per mile of road being 144,500.

Number of tons of revenue freight carried in 1901 increased 1,058,943 tons, or 29.6 per cent., increase over 1898 being 63.3 per cent. Ton-miles increased 193,075,056 tons, or 30.65 per cent.

While tonnage increased 29.6 per cent., and ton-miles 30.65 per cent., freight train-mileage increased but 5.27 per cent. Tons of revenue freight per train-mile were 287.8 tons, an increase of 24 per cent. over the previous year, and 59.69 per cent. over the six months ending June 30, 1899. In the face of a falling off of 8.94 per cent. in the receipts per ton per mile the freight train earnings increased 13 per cent. Total tons of all freight were 310 per train-mile.

Percentage of empty car-mileage was reduced from 33.97 per cent. in 1900 to 29.73 per cent. this year, and percentage of foreign car-mileage was reduced from 46.29 per cent. to 39.44 per cent., resulting in a saving in car mileage of $75,185 over the previous year.

Increase in the capacity of the freight car equipment has raised the average tonnage per loaded car from 14.34 tons last year to 16.92 tons this year. In 1899 the tonnage per loaded car was 12.53 tons.

Betterment of equipment has been an essential means to which the new Alton management has devoted much of its energies. What has been accomplished since the property came into their hands in adding to equipment and increasing carrying and hauling capacity will be seen by the following comparisons:

Freight car equipment:

| | No. cars. | Total dead wt. Tons. | Total capacity. Tons. | Average cap. Lbs. |
|---|---|---|---|---|
| Dec. 31, 1899 | 6,881 | 85,605 | 167,280 | 48,660 |
| June 30, 1900 | 9,386 | 127,146 | 264,770 | 56,400 |
| June 30, 1901 | 10,085 | 143,274 | 305,565 | 60,600 |
| Per cent. Increase 1901 over 1900 | 7½ | 12¾ | 15½ | 7½ |
| Per cent. Increase 1901 over 1899 | 46½ | 67 | 82⅜ | 24½ |

Locomotives number 201 against 204 on June 30, 1900, but many light engines have been replaced by heavier engines.

Cost of the rehabilitation of the road and equipment, since 1899, has been met largely by sale of the bonds of the new company. President Felton places the total expenditures for the work from April, 1899, to the date of this report as $8,225,739. To complete the work of grade reductions, block signaling, interlocking, track elevation, yard and side-track and terminal facilities, will involve about $3,000,000, one-half of this work being authorized and under way at the date of this report. While the work above outlined has been in progress the cost of operation has, necessarily, been largely increased, and the full benefit of the expenditures will not be realized until the work is completed, when a material decrease in conducting transportation and maintenance can be expected.

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*New York, New Haven & Hartford.*—The annual report of this company for the 12 months to June 30 last, shows that freight and passenger revenues did not hold all of the large increases recorded in the previous year when the gain in passenger revenues was $1,380,000 and in freight receipts was $1,783,000 with the total enhancement in gross revenues $3,182,000. The changes in the 1901 figures were, however, small, the gross receipts being reported at $40,132,311 for the rail lines, as against $40,325,152 in the previous year. Freight revenue alone decreased $300,000. Some saving was made in expenses, chiefly in equipment account, so that the decline in net earnings was only $16,480. Larger miscellaneous income and lower fixed charges enabled the company to show slightly higher available balance for dividends. The surplus over such disbursements, which were slightly enlarged in the year on account of treasury stock sold, was $363,550, as against $391,335 in 1900. A detailed income account for the last three years follows:

| Earnings: | 1901. | 1900. | 1899. |
|---|---|---|---|
| Freight dept. | $19,864,700 | $20,164,753 | $18,381,848 |
| Passenger dept. | 19,853,093 | 19,764,755 | 18,384,831 |
| Gross earnings | $40,132,311 | $40,325,151 | $37,143,917 |
| Expenses | 28,048,478 | 28,224,839 | 25,581,256 |
| Net earnings | $12,083,832 | $12,100,312 | $11,562,661 |
| Other income | 562,559 | 546,121 | 623,423 |
| Total net | $12,646,391 | $12,646,433 | $12,186,084 |
| Charges | 7,988,103 | 8,023,819 | 7,820,114 |
| Surplus | $4,658,288 | $4,622,614 | $4,365,970 |
| Dividends | 4,294,738 | 4,231,278 | 4,158,688 |
| Surplus | $363,549 | $391,335 | $207,282 |

Freight and passenger receipts and gross earnings of the company for a series of earlier years follow:

| | Freight earn. | Pass. earn. | Gross. earn. |
|---|---|---|---|
| 1898 | $14,081,857 | $15,901,669 | $30,322,738 |
| 1897 | 13,340,213 | 15,967,864 | 29,623,333 |
| 1896 | 13,772,070 | 16,274,100 | 30,345,630 |
| 1895 | 12,309,954 | 15,298,056 | 27,901,735 |
| 1894 | 10,423,547 | 14,858,329 | 25,281,876 |

Total gross earnings of the rail and boat lines combined were $44,295,541 in 1901, $44,310,853 in 1900, and $40,927,844 in 1899, certain steamer lines being included in one year and not in the other.

Details of the expenses in the last two years do not show any significant changes. In equipment account there was a saving of $549,000 in locomotive repairs, but increased expenditures for freight and passenger car repairs. In transportation account, expenses were remarkably uniform, cost of locomotive fuel, for instance, increasing but $19,000 in the total $2,911,000 charged. This increase, however, was against some contraction in train mileage.

Expenses, as reported above, include, however, as in 1900, very large sums for strictly betterment work, which might be legitimately capitalized. President Hall states the amount of such expenses for betterments, new equipment, and to meet general depreciation as $2,425,815 in 1901, as against $2,745,652 in 1900. This year's betterment expenses included cost of 27 new passenger cars and 500 new coal cars and part cost of 20 other new passenger cars, besides miscellaneous equipment; cost of stone ballasting on the Shore Line division; the Bridgeport improvements, new stations, bridge work, etc.

Changes in the financial accounts in the year included the issue of $10,000,000 3½ per cent. non-convertible debenture bonds, to pay all floating debt, to provide larger working capital and for present and future requirements. The bonds are payable in 1947, and $5,000,000 were sold in the year at a premium of $430,000. In addition $2,000,000 of the 4 per cent. debentures authorized in 1897 were issued last year, making $5,000,000 now outstanding, but authority to issue the remaining $5,000,000 was revoked. Some slight charges have been made to construction account in the year, mostly for real estate.

Changes in traffic and in train statistics for the last year follow:

| | 1901. | 1900. | Increase. |
|---|---|---|---|
| Average miles | 2,027 | 2,032 | *5 |
| Passengers carried | 53,051,460 | 52,096,900 | 954,560 |
| Tons moved | 15,436,435 | 15,708,270 | *271,835 |
| Passenger miles | 949,079,970 | 943,642,580 | 5,437,390 |
| Ton miles | †1,292,378 | 1,340,790 | *48,412 |
| Passenger train miles | 13,898,315 | 13,569,270 | 329,045 |
| Freight train miles | 5,969,950 | 6,344,140 | *374,190 |
| Passenger car miles | 58,030,516 | 56,659,000 | 1,371,516 |
| Av. tons loaded car | 10 1-3 | 10 1-5 | ..... |
| Average train load | 208 | 204 | 4 |
| Ton-mile revenue | 1.48c | 1.45c | .03c |
| Av. freight train haul | 83 3-4 | 85 1-3 | ..... |
| Freight train mile rev. | $3.20 | $3.07 | $ .13 |
| Passenger mile rev. | 1.76c | 1.78c | *.02c |
| Pass. train mile rev. | $1.40 | $1.43 | *$ .03 |

*Decrease.
†000 omitted.

Freight earnings per mile of road in 1901 were $9,798, passenger earnings per mile were $9,793, and gross earnings from operation were $19,796 per mile, net earnings being $5,960 per mile.

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*Louisville & Nashville.*—Gross revenues of this company in the year to June 30 last rose to $28,022,000 on 3,169 miles of road, gains in receipts having been continuous since 1894, when total revenues were $18,974,000 on 2,956 miles of road. The company, it will be seen, has higher earning capacity per mile of road than many of the large systems outside of the trunk line territory. Earnings per mile were $8,842 last year, as against $6,521 seven years ago. Net earnings in the same period have increased from $2,405 per mile to $3,089 last year. For a southern road these returns are exceptionally high, the Southern Railway, for instance, having gross receipts of $5,231 per mile on a ton-mile revenue of 9.46 mills, whereas Louisville & Nashville revenues are on a ton-mile rate of 7.69 mills in 1901, as against 7.58 mills in the previous year.

These low rates are largely the result of the company's heavy mineral traffic, a large mileage traversing the coal mining and iron manufacturing districts of Northern Alabama, but the exact proportions of this traffic to the total cannot be stated, as the report contains no table of commodity tonnages.

In part, however, high revenues per mile of road, as reported, are due to the manner in which certain of the company's lines are held, and their operations taken into the system accounts. Thus Louisville & Nashville owns or controls the majority stock interest in 5,324 miles, including the Nashville, Chattanooga & St. Louis of 942 miles, a majority of whose capital stock is owned. The report, however, covers only 3,169 miles and, except the Nashville & Chattanooga line, most of the other mileage is made up of lines of relatively light traffic and earning capacity. Only their final balance of surplus or of deficits to be met, is carried into Louisville & Nashville accounts. At present all of them yield credit balances, although in 1894 the company's own surplus was reduced by $319,000 for advances to meet charges of these lines.

It appears also from the present report, that Louisville earnings in the aggregate and per mile of road, as well as its traffic density (which, in 1900, appeared from the figures of the report to have reached 860,000 ton-miles per mile) have not been as large as have appeared from the available figures. That is to say, heretofore gross earnings have been credited with earnings on company freight. Operating expenses being charged in the same sum, net earnings as reported have represented actual revenue. This method of accounting has now been changed. Gross earnings and operating expenses as now stated for 1901 are actual revenue figures. As similar adjustments have not been made in accounts of previous years, this fact of course affects comparisons. Thus, on the face of the figures, (the report itself makes few comparisons except in traffic statistics and a table of 10 years' earnings) 1901 gross revenues were $280,000 less than in 1900, and gross per mile of road $383 less, comparing with $9,225 in 1900. Actually, however, there was an increase, if credits for company freight in 1900 (which the company has elsewhere stated as $1,131,300) are eliminated from that year's accounts as in 1901. In gross receipts the aggregate gain would run up to $1,411,000 with this adjustment, but allowing for the addition of 162 miles in length to average operated road in the year, gross per mile would show a decrease of $28.

Comparisons of the important items of revenue for the last three years follow:

| | 1901. | 1900. | 1899. |
|---|---|---|---|
| Average miles | 3,169 | 3,007 | 2,988 |
| Freight earnings | $20,419,162 | $20,699,799 | $17,100,715 |
| Passenger earnings | 5,742,581 | 5,238,314 | 4,905,584 |
| Total gross | 28,022,207 | 27,742,379 | 23,759,486 |
| Expenses | 18,233,034 | 18,603,406 | 15,731,588 |
| Net earnings | 9,789,173 | $9,138,973 | $8,027,898 |
| Per cent. exp. to gross. | 65⅝ | 67 | 66¼ |
| Other income | 704,688 | 650,045 | 540,645 |
| Total income | $10,493,861 | $9,789,018 | $8,568,543 |
| Charges | 5,965,274 | 5,782,181 | 5,707,032 |
| Sinking fund, etc. | 247,474 | 387,601 | 234,611 |
| Total charges | $6,212,748 | $6,169,783 | $5,941,642 |
| Net income | $4,281,113 | $3,619,235 | $2,626,901 |
| Dividends | 2,695,000 | 2,112,000 | 1,848,000 |
| Surplus | $1,586,113 | $1,507,235 | $778,901 |

The balance of income over all charges was $4,281,000, or 7⅞ per cent., on $55,000,000 of outstanding stock. This amount was increased by $2,000,000 in the year though the report nowhere contains any reference as to the purposes for which these proceeds were used. Out of this balance 5 per cent. dividends were paid, against 4 per cent. in 1900 and 11½ per cent. in 1899, when dividends were resumed after a five years' suspension. The development shown by the company in gross

and net earnings and in earnings per mile of road since that time are indicated in the following figures, compiled from those of the reports, except that in 1901 company freight is included for the sake of comparisons.

| | Miles. | Gross earnings. | Net earnings. | Gross per mile. |
|---|---|---|---|---|
| 1901..... | 3,169 | $29,215,900 | $9,789,173 | $9,217 |
| 1900..... | 3,007 | 27,742,379 | 9,138,973 | 9,225 |
| 1899..... | 2,988 | 23,759,486 | 8,027,898 | 7,951 |
| 1898..... | 2,988 | 21,996,653 | 7,074,922 | 7,361 |
| 1897..... | 2,981 | 20,372,308 | 6,523,089 | 6,834 |
| 1896..... | 2,965 | 20,390,711 | 6,885,505 | 6,877 |
| 1895..... | 2,956 | 19,275,994 | 6,998,221 | 6,521 |
| 1894..... | 2,956 | 18,973,337 | 7,110,552 | 6,419 |
| 1893..... | 2,942 | 22,404,639 | 8,020,997 | 7,615 |
| 1892..... | 2,858 | 21,235,722 | 7,443,599 | 7,430 |
| 1891..... | 2,250 | 19,220,729 | 7,162,284 | 8,541 |

Maintenance charges absorbed over half the expansion in gross earnings, and have risen from 21 per cent. of receipts in 1894 to 29.8 per cent. in 1901. Maintenance expenses are high actually, as well as relatively. Per mile of road they were $1,460 in 1900, and presumably there is no very great amount of double track or sidings, though no table of trackage is given in this report. In 1901, however, an expenditure of $256,000 was reported for side tracks, but only $7,792 for second track.

As regards transportation results, relatively small changes are reported in any item of tonnage or train statistics. Revenue ton-miles increased by 2⅞ per cent., freight train mileage in the same percentage, while revenue trainloads averaged 222.2 tons, against 220.4 tons in 1900. Loaded car mileage was practically unchanged in the year, but empty car mileage is increased by 7⅛ per cent., and empty car mileage was 32 per cent. of the total against 30⅔ per cent. in 1900 and 31.4 per cent. in 1898. Statistics of traffic and train movement for a series of years follow:

| | Ton. Miles. | Freight train. Miles. | Ave. rev. train load. |
|---|---|---|---|
| 1901..... | 2,655,984 | 11,342,900 | 222 |
| 1900..... | 2,581,673 | 11,027,300 | 220 |
| 1899..... | 2,230,767 | 10,866,160 | 205 |
| 1898..... | 2,011,368 | 10,383,300 | 194 |
| 1897..... | 1,737,231 | 9,708,600 | 179 |
| 1896..... | 1,674,658 | 9,133,300 | 183 |

Without attempting to enter into the circumstances affecting the trainload it may be pointed out that the Southern Railway in 1901 added 15 tons to its average revenue trainload, which is now 192 tons on a tonnage movement of 366,200 ton-miles per mile of road, against the 840,000 ton-miles per mile on the Louisville & Nashville.

*Chesapeake & Ohio.*—In our review of the annual report of the Chesapeake & Ohio, Sept. 27, we gave the ton-mile rate for 1900 as having been 3.62 mills; in fact, it was 3.43.

Last week in the review of the Illinois Central report, in a table of comparative traffic statistics, occurred a typographical error in certain ton-mile rates. It was, however, quite obvious.

A gold medal was recently given to Mr. Abram S. Hewitt by the Chamber of Commerce of New York city, as some recognition of his great services to the city, and particularly in the matter of forwarding plans for rapid transit. The Latin inscription on the medal, freely translated is: "By his genius benefactor of the city and conservator of public property." In presenting the medal the President of the Chamber of Commerce spoke of his gratitude to Mr. Hewitt "for the services you have rendered during your long life in promoting public measures that have contributed to make our city and nation great." In reply Mr. Hewitt said that in the course of a long life devoted largely to the public service he had been more accustomed to criticism than to commendation. Some day someone will prepare the story of Mr. Hewitt's life and then the citizens of New York and of the United States will recognize as they do not recognize now what a devoted and efficient patriot he has been. His services to our nation during the Civil War were of the highest importance and have never been appreciated except by few individuals who happen to know of them, and in a measure this is true of the work of his whole life.

## TRADE CATALOGUES.

*Hoisting Engines.*—A catalogue of 92 pages, containing information about hoisting engines and kindred devices has been issued by the famous house of J. S. Mundy, of Newark, N. J. Mining, quarrying, hoisting, dredging, transferring and pile-driving are considered and engine and boiler equipments are illustrated with many of the accessories that go to complete such operations.

*The S. Flory Mfg. Co.*, Bangor, Pa., has issued a 132-page catalogue descriptive of an extensive line of hoisting and conveying machinery. The company makes a specialty of hoisting engines, and some 50 pages are devoted to that subject. Considerable space is given to illustrations and descriptions of the suspension cable system of hoisting and conveying, and other important specialties.

*Hydraulic Jacks.*—The Watson-Stillman Co.'s Catalogue No. 61 covers this subject quite fully. Horizontal, transfer, traverse, and other types of hydraulic and ratchet screw jacks are illustrated and described. Vreeland pit jacks, street car motor lifts, and a double-acting welding machine jack are among the striking features. There are concise and correct instructions for the care and use of these devices and the catalogue is altogether worth having. Offices are at 204 East 43rd street, New York, and 453 Rookery, Chicago.

*Convertible Cars.*—The Rodger Ballast Car Co., Fisher Bldg., Chicago, has just issued a catalogue illustrating the Convertible Hopper and Flat-Bottom Gondola Car, Class C-C. There is an introductory page of directions for converting the car from hopper to flat-bottom, followed by eight pages of good half-tone illustrations with a short descriptive paragraph under each illustration. The catalogue tells the story of advantage pointedly, and a fuller illustrated description of the car was given with an inset in our issue of Sept. 20, page 652.

## Air Compression at Altitudes.

The August number of *Compressed Air* contains an article on this subject written by Mr. F. M. Hitchcock for *The Economist*. Two tables and other essential parts of the matter are here given.

The effect of the altitude at which air compressors are to operate is an important matter and often overlooked. The capacity of a compressor in free air, or the volume displaced by its piston, is of course the same under all conditions. As free air, however, varies in its nature with given heights, the amount of compressed air delivered by a compressor under a specific pressure also changes at different altitudes. The barometric pressure of air, usually taken as 30 inches at sea-level and corresponding to a pressure of 14.7 pounds per square inch, owing to diminishing density, decreases with increasing height above sea-level, because the air becomes more rarified. On this account, the efficiency of an air compressor of given capacity measured in the delivered compressed air decreases rapidly as the altitude increases, so that the usual figures made for sea-level do not apply. As the atmospheric pressure decreases, the mean pressure required on the air piston for a given terminal pressure is lowered so that the power necessary to compress a constant piston displacement of air lessens as the altitude increases. It is found, nevertheless, that the decrease in the efficiency of the air end is at a much faster rate than the decrease in the power required to compress a given volume. On this account, to deliver an amount of compressed air in various altitudes at a certain gage pressure, which is equivalent in effect to that at sea-level, requires in reality more power than at sea level.

The comparative efficiencies of sea level and altitude compressions are given in Table A for the common working pressures of 80 and 100 pounds. It also shows the percentage increase in capacity necessary at different heights to be equivalent to sea-level conditions, and the increase in horse-powers required to accomplish this result.

At sea level for a pressure of 80 pounds or over, it is advantageous to compress air in two or more stages, but owing to the decrease in atmospheric pressure at altitudes, the number of compressions of the air necessary to attain the required gage pressure is increased, and it is, therefore, far more economical to compound at such points than at sea level. For the same reason it pays to compound for lower pressures at altitudes than at sea level. These facts are becoming more and more appreciated, and to-day for standard working pressures, nearly all compressors of much size installed at altitudes are of the compound type. Table

TABLE A—SINGLE COMPRESSION AT ALTITUDES.

| Altitude in feet. | Barometric Pressure. Inches of Mercury. | Lbs. per sq. in. | Per cent. of efficiency volume, 100 per cent. at sea level ..... Gage. 80. | 100. | Per cent. increase in volume to give efficiency equivalent to sea level. Gage. 80. | 100. | Horse-power to compress 1 cu. ft. of free air..... Gage. 80. | 100. | Per cent. of power to compress. Same piston displacement ..... Gage. 80. | 100. | Per cent. increase in power required to compress the volume of air equivalent to a given volume at sea level..... Gage. 80. | 100. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0..... | 30.00 | 14.75 | 100.0 | 100.0 | 0.0 | 0.0 | .1585 | .1800 | 100.0 | 100.0 | 0.0 | 0.0 |
| 2,000..... | 27.80 | 13.67 | 93.8 | 93.6 | 6.6 | 6.8 | .1536 | .1744 | 96.9 | 96.8 | 3.3 | 3.4 |
| 4,000..... | 25.76 | 12.67 | 87.8 | 87.5 | 13.9 | 14.2 | .1486 | .1685 | 93.7 | 93.6 | 6.8 | 6.9 |
| 6,000..... | 23.86 | 11.73 | 82.1 | 81.7 | 21.8 | 22.4 | .1438 | .1629 | 90.7 | 90.5 | 10.6 | 10.7 |
| 8,000..... | 22.11 | 10.87 | 76.9 | 76.3 | 30.0 | 31.0 | .1391 | .1571 | 87.7 | 87.3 | 14.1 | 14.3 |
| 10,000..... | 20.49 | 10.07 | 71.9 | 71.2 | 39.0 | 40.0 | .1348 | .1515 | 85.0 | 84.1 | 18.2 | 18.3 |

B shows the volumetric relationship at altitudes for a wider range of pressures than given in the former table, and also the horse-powers required to compress free air to these several pressures, by two-stage compression.

An illustration of the use of this table is as follows: 1,000 cu. ft. of air compressed to 80 lbs. in two stages at sea level develops 1,000 × .137 = 137 h.p. Considering the compression to be at an altitude of 10,000 ft., we note from the table that the volume to be equivalent at this pressure must be 39 per cent. greater, or 1,390 cu. ft. The horse-power factor for compression to 80 lbs. at 10,000 ft. altitude is seen to be .113 per cu. ft., then 1,390 × .113 = 157 h.p. is developed under these conditions, or 157 — 137 = 20 h.p. more than at sea level is required for the same effect.

The figures for horse-powers given in both tables neglect friction losses, for which from 10 per cent. to 15 per cent. should be added, depending upon the quality of the compressor used. In connection with the above, it should be borne in mind that steam actuated compressors exhaust into a lower atmospheric pressure at altitudes, which diminishes the back pressure and, therefore, for the same gage pressure as at sea-level, this causes a gain in the net mean effective pressure obtainable from the steam. This fact should be considered in designing steam-actuated air compressors to work at altitudes.

TABLE B—TWO-STAGE COMPRESSION AT ALTITUDES.

| Altitude. In feet. | Percentage of efficiency of air at altitudes considering its volume, 100 per cent. at sea level. Gage Pressure. 60. | 80. | 100. | 125. | 150. | Horse-power to compress one cu. ft. of free air to— Gage Pressure. 60. | 80. | 100. | 125. | 150. |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.... | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | .1175 | .1375 | .1535 | .1708 | .1859 |
| 2,000.... | 94.0 | 93.8 | 93.6 | 93.4 | 93.3 | .1143 | .1324 | .1481 | .1641 | .1781 |
| 4,000.... | 88.3 | 87.8 | 87.5 | 87.2 | 87.0 | .1097 | .1273 | .1422 | .1574 | .1707 |
| 6,000.... | 82.8 | 82.1 | 81.7 | 81.2 | 81.0 | .1059 | .1228 | .1362 | .1510 | .1634 |
| 8,000.... | 77.7 | 76.9 | 76.3 | 75.8 | 75.4 | .1020 | .1180 | .1308 | .1445 | .1563 |
| 10,000.... | 72.8 | 71.9 | 71.2 | 70.6 | 70.2 | .0984 | .1133 | .1254 | .1384 | .1493 |

## The Use of Conveyors in Handling L. C. L. Freight.

The present method of handling package freight at railroad warehouses and transfer points has been developed from an old-fashioned Irishman and his wheelbarrow, in many respects, the happiest and most effective combination that could be seen, but in construction work they have been almost obliterated on heavy work (where indeed they were formerly only used in conjunction with the horse and cart) and now horse-scrapers, cars and track, conveyors and machinery have been introduced, naturally following a close calculation of economical haul.

Freight warehouse work, on the contrary, when heavy is carried on in much the same style as when light, and the hand truck and the truckman we see in large city stations moving every day from 700 to 1,500 tons of miscellaneous package freight, and the whole method of work is the same as at small stations handling one-tenth the tonnage. And also even at transfers handling from 1,200 to 1,800 tons per day still we find the same hand labor and hand truck.

The above figures are large, but we are living in the days of big figures when we deal with totals, and of small figures when we deal with units, and if concentration of capital leads to concentration of work and tonnage, our totals will continue to increase and our units will need yet more careful watching.

Assuming a station loading only 200 tons, or say 35 to 40 cars per day outbound, a saving of 3 cents per ton would justify the expenditure of $40,000 in additional plant, and if the changes also assist in the movement of the inbound tonnage and increase the capacity of the station the results would justify the change of methods.

If an average package weighing 160 lbs. and 3½ ft. long can be delivered at a car door every 10 seconds and the packages could be stowed in the car at that rate an average car would be filled in from 10 to 12 minutes.

A movable endless platform, flush or almost flush with the floor, moving at the slow rate of 2 miles an hour would move from 12 to 14 cars of package freight per hour, allowing 6 ft. between each package, and these notes are intended to point out the possible application of such an arrangement.

This method of moving packages is not unknown in handling packages of one kind, such as hogsheads of sugar or barrels of oil from a given point to another fixed point, but it is not applied to moving miscellaneous freight from one point to several points, and the economy of its use would largely depend upon the possibility of employing to advantage the labor necessary for its operation. The cost of power and repairs in operating such a conveyor of any reasonable length would probably not exceed $2 an hour, or 20 cents a car when fully employed, but economy in the *labor* tending a machine is always a grave question.

Speaking generally, it is often more economical in the end to over-equip than to be forced to over-man, and in this general plan to turn most of the hauling in a freight house into longitudinal hauling in one direction along the tracks and to do this long longitudinal hauling by machinery, it is quite possible that, in order to make it most effective, the short transverse hauling at right angles to the track and conveyors should not be performed entirely by hand trucks, but in some cases by transverse conveyors, possibly of a more simple type than the long longitudinal conveyor.

### *At Transfer Stations.*

Let us assume that about 10 per cent. of the freight arriving in each car at a transfer station on the aver-

age is left in the same car and forwarded from the transfer station as at present operated. This 10 per cent. of freight, however, is checked and re-stowed under the present system, but under the proposed system each inbound car would be entirely unloaded and run into the pool for outbound loading, according to its ownership, which is an advantage for the new. On the other hand probably every piece would be handled twice as much as at present, which is *against* the new method.

Say that about one-half the freight at the transfer station is loaded in solid cars to destination and one-half is loaded in order of stations so that the freight can be unloaded at destination by the crews of distributing way freight trains. Bearing these facts in mind the use of the conveyors should be followed out by reference to the following plan (Fig. 1): Opposite each package on the waybill or copy of waybill, if a copy is used, will be marked the number of the loading group in which it is to be loaded and probably another number for its full identification. These numbers are marked on each package as it is unloaded, either by paint or tag, and the package moved across the platform from the inbound car at A to the head of the conveyor at B. The package is loaded on the conveyor at B and unloaded opposite its proper outbound car.

Of course, if cars could be set for every destination, which would be covered in say 12 hours, most of the packages could be moved from the inbound car directly to the outbound, but at a transfer station forwarding 300 cars a day this is not possible, on account of the expense of a long conveyor. Probably not more than 80 cars outbound could be placed at one time, using four outbound tracks instead of two as shown in the plan. With 80 cars set up, however, for outbound destinations probably 75 per cent. of the inbound tonnage could be moved to the outbound platform for loading. Of course, the outbound platform must be of sufficient width to allow the freight for station order loading to be posted and arranged for proper loading. Also some of this platform could be used for posting outbound freight for which the cars are not placed. Some of this freight, however, arriving eight hours or more before it is due to leave, which possibly would be 25 per cent. of the total would be held on the inbound platform and moved down as needed. The number of each package would be noted as it is loaded in the outbound car, thus forming an absolute check. It must be understood also that the outbound cars are arranged to go out regularly according to their schedules and are not used indiscriminately to load inbound tonnage as it arrives, and the whole work is to be regulated by the time the different cars arranged in their order for each schedule are to be ready. When there is a special run of freight for any schedule additional cars would have to be placed and loaded quickly, but generally necessary allowances can be made.

We will not here go into any of the details of the operation except to state that the unloading of the inbound cars would be carried on very quickly, allowing about five minutes to a car, and to do this work hand trucks would not enter the cars. Movable or fixed roller frames would be used when necessary and the trucking to the conveyors would be kept steadily going.

### *At City Stations.*

If a freight station handles about 80 loaded cars inbound and the same number outbound per day the amount of platform space necessary for the movement in each direction and the number of shifts of cars on the tracks which can be made in 24 hours form the controlling items of any theoretical design which does not take into account the cost of land. (See Fig. 2.) There are some city stations so unfortunately situated as regards track movement (being regulated by city ordinances) that only one shift can be made in 24 hours, but such stations are very rare. It is almost superfluous to state that the location of city stations is a most important subject when we consider both the commercial and operating advantages and something may be added on this matter at a later date, but it is sufficient here to note that a freight station yard is a much more necessary accessory to a freight station than we usually appreciate.

Speaking generally, we can assume the receipt, weighing, sorting and holding for a short time for the necessary cars requires for outbound freight 200 sq. ft. per car handled daily and that the unloading, sorting and holding package freight for consignees to remove inbound freight requires 400 to 500 sq. ft. in platform space per car handled daily. These figures are deduced from some examinations made some years ago at a few large city stations.

Therefore, 80 cars inbound would require 32,000 sq. ft. of platform and 80 cars outbound 16,000 sq. ft. Of course, these figures are largely affected by different methods of hauling and storage, but they can be accepted as approximate for purposes of design, and it may be assumed that stations having less than this space are obliged to carry on their work at the sacrifice of labor in piling goods to an uneconomical height on the platforms.

The accompanying plan is submitted for a city station, where 3 or 4 shifts can be made handling 80 (or more on emergency) cars, inbound and outbound each, per day, and where the station labor is supplemented by longitudinal conveyors. The plan shows four tracks, each holding six or seven large cars and on account of the conveyors the general plan differs somewhat from that in ordinary use as it will be noticed that the outbound platform is at one end only and the inbound platforms alone are along each side of the tracks.

This arrangement of outbound platform can be seen at stations located at piers on navigable waters where the cars are moved or shifted on floats or flatboats holding tracks as can be found in general use at New York, Philadelphia and similar points. The long trucking to and on the floats in such cases, however, is in practice done by hand trucks and not by conveyors as proposed.

The operation outbound, therefore, would be similar to that in use at such river stations, and inbound the handling would be very similar to that at an ordinary freight station. Conveyors have been added on the inbound platforms, however, to assist in the separation of large lots of inbound freight for consignees, taking quick delivery from the small lot freight for consignees who may have no regular arrangements for hauling.

These conveyors would generally only be used on inbound freight during the morning and during the busy outbound period in the afternoon they could be used to assist in the outbound movement. In order to make them most available they should be constructed to operate in both directions if needed.

Any general design of this kind should have in view a possible increase of business and consequent enlargement of facilities. It would be advisable that the outbound platforms be built of temporary construction, as this platform is always emptied every night and, therefore, for a slight increase in outbound business there should be allowance made in locating the building so that this outbound platform could be removed bodily in the direction of the street and widened proportionately and the conveyors extended. If this increase is also accompanied by an increase of inbound business the permanent inbound sheds could be raised another story and, by the use of continuous elevators to lift barrels, crates, baskets and similar packages, they could be stored on the second story and slid down chutes to the city drays as required. In case of a consolidation of freight stations and a heavy increase in business the plant could be duplicated in plan, but not necessarily in size. The unloading of large lot inbound freight by each inbound conveyor could be carried on for one car at a time, the freight being loaded on the conveyor from a rolling bridge free from and over the conveyor, and this bridge could be moved from car to car as required. The small lots would then be unloaded and moved by hand trucks across the platform, as is the present custom. The statement of facilities would be as follows:

| | |
|---|---|
| Length of track, each 240x4..... | = 960 ft. |
| Area of inbound = 240 ft. long x 50 ft. wide + 100 ft. long by 40 ft. wide, each side..... | = 32,000 sq. ft. |
| Area of outbound = 170 ft. long x 100 ft. wide | = 17,000 sq. ft. |
| Also central shed for outbound handling..... | = 10,000 sq. ft. |
| Number of cars (track room)..... | 24 to 28 |
| Number of shifts per day..... | 3 or 4 |

G. S.

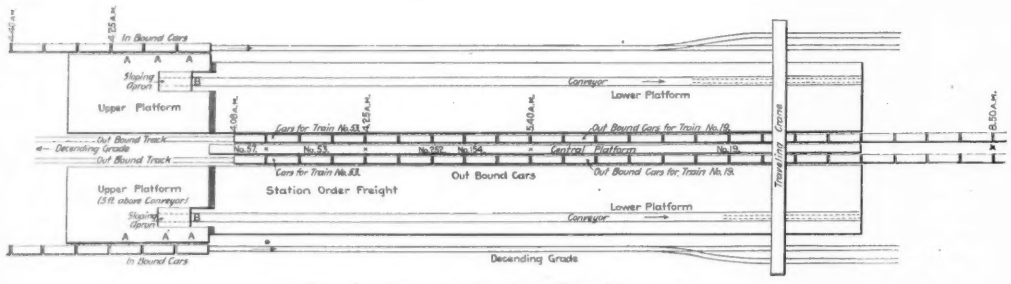


Fig. 1.—Transfer Station, With Conveyors.

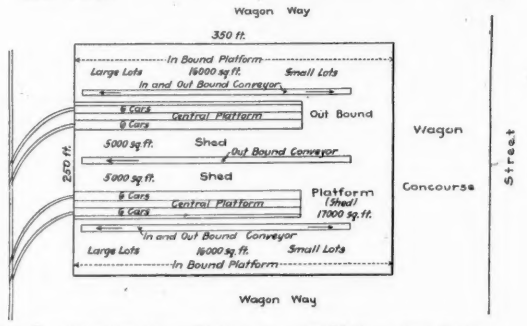


Fig. 2.—City Station; 80 Cars in and 80 Cars Out Daily.

## Use of Alcohol in Internal Combustion Motors.

There was published in the Memoirs of the Society of Civil Engineers of France for July, an elaborate paper by M. Lucien Perisse, on Alcohol Motors. The author considered the subject one of importance and argued that, owing to the magnitude of the alcohol industry in France, and the cheapness of the product, it was to be preferred to the petroleum products as a fuel for internal combustion motors.

In reviewing the condition of the art he stated that but one alcohol motor was shown at the exposition of 1900, whereas in 1901 at the Bicycle and Automobile Exposition, held in February, another was shown and several makers of automobile engines claimed that theirs would work equally as well with alcohol as with gasolene. And again, in May, 1901, at the Agricultural Show at Halle, in Saxony, there were a large number of alcohol motors exhibited. The author counts upon the high price of petroleum products and the ease with which alcohol can be manufactured for the introduction of motors using the latter fuel into the colonies.

The article includes quite an exhaustive discussion of the physical and chemical properties of alcohol and the petroleum products in which it is stated that alcohol requires 7 lbs. of air per pound of liquid for its combustion, by which 12,677 heat units will be developed. Pure alcohol is not, however, best suited for engine work, but should be adulterated with a small percentage of benzine, which reduces its calorific power and brings it down so that, from the standpoint of the production of heat, this carburetted alcohol is the equivalent, volume for volume, of gasolene.

For a long time attempts have been made to increase the calorific power of alcohol by mixing with it some substance rich in carbon. These attempts have resulted in the production of carburetters, by which benzol or a pure quality of benzine has been added.

Some figures are given regarding gasolene. Crude American petroleum gives up about 18 per cent. of the liquid in the form of gasolene at temperature of from 160 deg. to 240 deg. Fahr. The Caucasus oils yield only 5 per cent. The average composition of crude oil is, carbon 879 parts, hydrogen 121 parts. Crude petroleum also contains 8 to 20 per cent. of oxygen that disappears upon rectification. The average calorific power, as derived from a large number of experiments, is 18,324 heat units.

The principal application of alcohol as a motive power has been in four-cycle internal combustion motors. Attempts have also been made to use alcohol for heating small boilers, but this has amounted to but very little.

In order that alcohol may be used explosively, two distinct sets of apparatus are needed; a generator of the explosive mixture, or the carburetter and a transformer of the energy or the motor proper. No motor has been developed that is especially adapted for the use of alcohol.

The carburetters may be divided into four classes: Carburetters for surface evaporation; those for atomizing the liquid by a current of air; those that distribute it; those used for gasolene. The question of the heating of the carburetters is one of the most important, so that the trouble with non-gasified alcohol may be avoided. This heating, even to that of reaching considerable intensity, seems to be a matter of importance. It is necessary that the temperature should be in the neighborhood of 212 deg. Fahr. in order that the liquid may be thoroughly gasified. On the other hand, care must be taken not to introduce the gas into the cylinder at too high a temperature lest the valves be corroded and the efficiency be diminished by a modification of the compression.

The first attempts to use alcohol in internal combustion engines was made in 1894, and since that time the experiments have been repeated and continuous, and it may be gathered that, with pure alcohol, the consumption will be about 0.92 lbs. per horse-power hour. The addition of benzol to the alcohol cuts down the consumption until, when the benzol forms 20 per cent. of the mixture, the consumption has fallen to 0.81 lbs. The addition of more benzol causes the rate of consumption to rise again.

In discussing the carburetter the author lays down the following requirements: There must be a complete evaporation of the alcohol so that no particle of liquid shall be allowed to enter the motor; the alcoholic vapor must be mixed with a larger quantity of air than where gasolene is used; and the mixture of air and alocohol must be very complete so as to form a homogeneous explosive. As for the motor proper, without entering into a detailed discussion of the theory of explosive motors, it has been found that the alcohol engine runs more smoothly and noiselessly than other explosive motors; but, in order to utilize the fuel to the best possible advantage, the motor should have a long stroke and a high compression.

Among the allied matters, that of lubrication should be carefully attended to, since a somewhat different set of conditions prevail with alcohol than with gasolene. The alcohol holds other substances in solution to such a degree that its effect is to completely dry the valves or metallic parts over which it passes. On the other hand, gasolene, while readily dissolving the oils, is, of itself, something of a lubricant. It is not necessary, then, to lubricate more than with gasolene, for, in nine cases out of ten, too much oil is used; but to do it more intelligently and in proper quantities. The decomposition of the water set free in explosive motors is a matter of some importance, for this water is not merely evaporated but it is decomposed. This sets free a quantity of oxygen

that acts as a powerful corrosive. This trouble may be obviated by using a homogeneous explosive mixture.

Attention is called to the fact that about 45 per cent. of the heat set free by the explosion is lost through the exhaust as against from 18 to 19 per cent. utilized for work. It is suggested that it would be a useful field of investigation to ascertain whether more or less is lost with an alcohol than with a gasolene motor.

In summing up his conclusions the author says that, in order to make the alcohol motor all that it ought to be, it is of the first importance that the mixture should be formed by special apparatus in which the volume and consequently the velocity of the gas and also its temperature shall be carefully regulated. The fuel should be used in motors with long stroke and high compression, and whose other details can only be worked out by careful experiment and practical trial. A high grade of alcohol enriched with special hydrocarbons should be used. That is to say alcohol containing about 14 per cent. of water gives better results as a motive power than that which is more nearly pure. The question of cost is also an important element and its reduction will serve to put alcohol on the same footing as the petroleum oils. It remains then to make a careful investigation of the relative values of pure and carburetted alcohol from an economical standpoint in order to determine the actual status of this class of motor and it is expected that these figures will be forthcoming in the course of the next few months.

## TECHNICAL.

### Manufacturing and Business.

The Eaton, Cole & Burnham Co., of Bridgeport, Conn., makers of brass and iron goods for steam, water and gas, will build a steel and brick foundry building 400 ft. long and 150 ft. wide, together with power plant and buildings for tumbling barrels, cores, pattern storage, tapping department, sorting, storage, shipping, etc. Contracts for the entire work have been let to Berlin Construction Co., of Berlin, Conn.

### Iron and Steel.

The large floating steel dry dock built at the Maryland Steel Company's plant at Sparrow's Point will be floated on Oct. 12. The dock is in three sections, which will be united before it starts on its trip to Algiers, La.

The Carnegie Steel Company has finished the two great merchant bar-mills which it has been building during the last year at Duquesne, Pa. It will soon be put in operation, employing 1,200 men. The new mills cost more than $2,000,000.

It is said plans are now being made for the extensions to the armor plate plant of the Carnegie Company at Homestead, which is necessary for a larger delivery of armor plate to the Government. The Bethlehem Steel Co. will also enlarge its armor plate plant.

Application has been made in Pennsylvania for a charter for the Ft. Pitt Malleable & Gray Iron Co. The incorporators are: John C. Reilly, James D. Callary, Frank J. Lanahan, John Murphy and J. A. Weldon, of Pittsburgh. The company will locate near Pittsburgh.

Statistics collected by the British Iron Trade Association show that in the first half of the year 1901 the total production of pig iron in the United Kingdom was 3,884,544 tons, against 4,540,403 tons in the first half of the previous year, a decrease of 655,859 tons. This indicates a total production in 1901 of less than 8,000,000 tons. The production in 1900 was reported by the British Iron Trade Association to have amounted to 8,908,570 tons.

All records for production of steel were broken at the Edgar Thomson Steel Works and in the structural department of the Homestead works of the Carnegie Steel Company in September. The total tonnage of ingots in the converting mills of the Thomson works was 74,000. The blooming mill furnished 65,315 tons, and the rail mill 59,810 tons. All previous records were shattered in September in the production of structural shapes, beams, channels, angles and tees at Homestead. The best previous record was beaten by a total of 3,500 tons.

### Pintsch Gas Plant at St. Paul.

The Safety Car Heating & Lighting Co. has installed a Pintsch gas plant at St. Paul, Minn., and filling valves are now in place in the Union Station, and everything is ready for charging cars in that station.

### The Massena Power Plant.

October 1, water was turned on the wheels of the plant of the St. Lawrence Power Company, at Massena, N. Y. The actual work on this enterprise was begun about four years ago and we have described it in more or less detail at various times since.

### A River and Harbor Congress.

A "National River and Harbor Congress" was held in Baltimore, Md., Oct. 8 and 9. The preliminary object is to "initiate action, having for its end the continuance of such a national policy in the improvement of rivers and harbors as will secure to our country the prompt development of its producing commercial, maritime and transportation possibilities."

### The Brooklyn Bridge.

The board of experts appointed to consider and report upon the Manhattan terminal of the New York & Brooklyn Bridge presented their report to the Bridge Commissioner on Tuesday afternoon of this week. It will be given out for publication within a few days. The board, it may be remembered, consists of A. P. Boller, H. G. Prout and S. Whinery.

### To Enlarge Locomotive Plants.

The directors of the American Locomotive Company have authorized the expenditure of $1,250,000 to enlarge the capacity of the several plants to a total annual capacity of about 2,000 locomotives. The greater part of this money will be spent upon the Brooks and Schenectady Works. Some time ago the company authorized the expenditure of $500,000 to increase the capacity of its plants.

### Am. Soc. C. E. Committee on Rail Sections.

At the September meeting of the American Society of Civil Engineers it was announced, in reference to the vote on the appointment of the proposed Special Committee on Rail Sections, that: Total number of votes received to date was 542; one-third of the corporate membership at the time of sending out the ballot, 670; number of additional votes needed before count can be made, 128.

### The New York Rapid Transit Power Houses.

John B. McDonald, contractor for the New York Rapid Transit railroad, has awarded to the Westinghouse Electric & Manufacturing Company the contract for the electrical equipment of the power house and substations, aggregating $1,500,000. The contract calls for six 5,000-k.w. alternators, three 250-k.w. exciters, 26 1,500-k.w. rotary converters, 78 550-k.w. transformers and eight moto-generator starting sets. The third-rail system will be used. There will be one main powerhouse, at Fifty-eighth street and Eleventh avenue, and eight sub-stations. It is expected that it will take two years to build and equip the main powerhouse.

### A New Deep-Water Port.

An officer of the Gulf & Ship Island Railroad writes that the company is engaged in dredging a channel 300 ft. wide from Ship Island Harbor, Mississippi Sound, to the pier at Gulfport, Miss., which is the terminal of the line. By the first of November the channel will be dredged 85 ft. wide and 21 ft. deep at low tide to the pier, and it is thought that it will be 160 ft. wide and the same depth by the middle of January. By next spring the company hopes to have the channel complete, and also to have the anchorage basin at the pier and near the shore wide and deep enough to receive vessels. It is planned to have ships and boats come to the company's pier through the narrow channel this fall. The undertaking, when completed, will necessitate the double tracking of the line to Jackson, Miss., where a connection with the Illinois Central is made, and it will serve to relieve the congestion of the dockage at New Orleans.

### Exhibit of the Bucyrus Co. at Buffalo.

Many people have this summer visited the exhibition at the Pan-American Exposition of the Bucyrus Co., of South Milwaukee, Wis. In a small building near the Terminal Station, where this exhibit is installed, are to be seen models and photographs of dredges, steam shovels and railroad wrecking cranes. On the tracks at one end of the station is a 65-ton steam shovel with a 3-yd. dipper, being one of the largest machines so far built. This shovel is shown under steam. Three engines are used; two are mounted on the body of the car and drive the swinging and hoisting gear; the third engine is mounted on the boom and controls the thrusting movements of the dipper handle through a rack and pinion. The swinging engines have cylinders 7x7 in. When in service the load at the forward end is carried through an A-frame and jack-arms to the ground, so that the frame of the car is relieved of these loads. The boom is suspended from the A-frame. When in transit the dipper is carried on a flat car, and the boom and post is lowered to suit the clearance limits of the road. The machine can be moved slowly along the track through a chain connection to one of the axles. One of the first shovels of this type built by the Bucyrus Co. was described in detail in our issue of September 17, 1897. Since then many have been built and used in the hardest service with excellent results.

### 30,000 H. P. Electric Plant Near Omaha.

Omaha, Council Bluffs and neighboring towns are now promised an electric power and lighting plant in common, which shall be next in size to the Massena and Niagara plants. Mr. R. N. King, of New York, who is directing the finances of the project, endorses the following extracts from a New York paper:

"The plan contemplates the development of 30,000 h.p. It is proposed to build a canal 30 miles long from Linwood on the Loup River to Fremont on the Platte River. This canal will carry the waters of the Loup River through a natural formation that lends itself readily to the work and empties into a reservoir on the Elm Creek canon at Fremont, Neb., where the bluffs rise 200 ft. above the Platte River. There is a land-locked basin large enough to hold 14,000,000,000 gals. of water, requiring only one dam to close it up. Above the dam will be erected the general plant, which will generate power from the fall of 157 ft. and will send the electric current to Omaha, less than 28 miles away. The power derived from the plant will, according to the engineers' figures, be equal to 30,000 h.p. for 24 hours a day, or 50,000 h.p. for 10 hours a day. This power is to be used by the consolidated street railway and electric lines, the suburban lines out of Omaha and Council Bluffs, the electric lighting systems of the four cities concerned, and the manufacturing plants in these four cities and intervening points.

## THE SCRAP HEAP.

### Notes.

On the Delaware, Lackawanna & Western the number of brakemen on passenger trains is now one to each train in all cases, except on the heavy trains of the main line.

A special tax revision commission in Kansas has drafted a bill, to be presented to the next Legislature, requiring the payment of taxes on freight cars used in the state but owned in another state; and a clause in the bill requires railroads to make regular reports of the mileage, within the state of Kansas, of all foreign cars run by them.

The South Side Elevated road, Chicago, has increased the wages of conductors, guards and motormen about 10 per cent. The men struck on Sept. 28, but reports indicate that the company was easily victorious in the contest, without regard to the increase in wages; and the officers of the road state that the increase was being considered before the strike began.

### Traffic Notes.

At Cape May Court House, N. J., Oct. 2, two ticket brokers of Cape May, having pleaded guilty, were fined $50 each for scalping round trip excursion tickets.

A Massachusetts paper says that during the months of July and August the number of bicycles carried in the baggage cars of the Boston & Maine was about 60 per cent. less than during the same months of 1900.

On Saturday last, the Southern Pacific ran an excursion from San Francisco to Lake Tahoe, about 225 miles, at a round-trip fare of $8.50, which included 50 miles of steamer transportation on the lake.

Press despatches from Sioux Falls, S. Dak., say that all of the three principal railroads of that state, the Chicago, Milwaukee & St. Paul, the Chicago & North Western and the Great Northern, will at once reduce passenger rates from 4 cents a mile to 3 cents, and that they have asked the State Railroad Commissioners to appoint a conference with a view to making reductions in freight rates. The reader will recall that the action of the State Railroad Commissioners, four years ago, in ordering the railroads to make lower rates, was lately declared invalid by the United States court.

A press despatch from Buffalo says that the railroads of the Central Passenger Association have voted to sell on three days in each week, during the month of October, round-trip tickets to Buffalo for about one-half the one-way rate, or a reduction of 75 per cent. from regular fares. These tickets will be good for six days. The rate from Chicago will be $6.75, from Cincinnati $6.15. On and after Oct. 9 a reduction of 25 per cent. on the present reduced Exposition rates will be made by the New York Central from stations within a radius of 150 miles from Buffalo. Excursions from specified points will be arranged covering almost every day between now and the close of the Exposition. On Oct. 18, 25 and 30 a round trip rate of $5 from New York City will be made, good over all the roads between the two cities.

### Railroad in German Southwest Africa.

Consul General Hughes, of Coburg, reports that a railroad to connect Iwakopmund and Windhoek, in German Southwest Africa, is in course of construction. Last year, 194 kilometers (120 miles) from Iwakopmund to Karibib, were completed and traffic was opened on that portion a few months ago. For the fiscal year 1901, 3,000,000 marks ($714,000) have been appropriated for continuing the line toward Windhoek. After the whole line is completed it is planned that two freight trains shall be run daily and two passenger trains weekly. In the construction of the passenger cars, particular care will be taken to offer every possible comfort and protection to travelers. It is proposed that seats shall be provided which, by turning, can be converted into beds. The cars will be protected by sunshades, dark glass, and window screens. Stations will be established at Iwakopmund, Windhoek, Okahandja, and Karibib. The last, being well provided with good water, will be the central and repair station of the new line.

### Technical Schools.

*Purdue University.*—The fall term of Purdue University opened Sept. 12, with a Freshman class of something over 300. By the close of the first week a thousand students were in attendance, indicating that the total enrollment for the year will exceed 1,200. Of those already enrolled 766 are taking engineering courses, and 300 are in the course of mechanical engineering. The special work of this course in locomotive and car design is inaugurated this year under the direction of Prof. William Forsyth.

### Grade Crossing Ordinance Passed in Allegheny.

The ordinance which provides for the abolition of grade crossings in the city of Allegheny and permits the Pennsylvania Co. to make about $2,000,000 worth of improvements, was passed by the Allegheny Common Council on Oct. 3, and will now come before the Select Council.

### Pressed Steel Car Company.

The Pressed Steel Car Company will hereafter issue quarterly statements of earnings. It has made public the results of the half year to June 30, as follows: Net earnings, $1,082,000; preferred dividends (3½ per cent.), $438,000; interest and depreciation, $160,000; balance available for common stock, $484,000.

### American Society of Railroad Superintendents.

The Secretary has sent out the following notice of postponement:

It has been decided to postpone the Thirty-urst meeting of the Society, from Wednesday, Oct. 16, to Thursday, Oct. 24, at 10:30 a.m., at Buffalo, N. Y., in the Iroquois Hotel. Election of officers and other matters of grave importance are to be acted upon, and it is hoped that all who have already so signified will come, as well as others who may have found the first date inconvenient. C. A. Hammond, Secretary, Mt. Vernon, N. Y.

## LOCOMOTIVE BUILDING.

*The Pere Marquette* is asking bids on 10 10-wheel locomotives.

*The Intercolonial* has ordered 20 engines from the Kingston Locomotive Works,

*The Pittsburgh & Lake Erie* are in the market for 1,000 steel hopper-bottom coal cars.

*The Seaboard Air Line*, it is stated, will order 10 freight and six passenger engines.

*The Dominion Steel Co.* has ordered 20 locomotives from the Kingston Locomotive Works.

*The Algoma Central & Hudson Bay* has ordered 20 locomotives from the Kingston Locomotive Works.

*The Michigan Central* is having 20 engines built at the Schenectady works of the American Locomotive Co.

*The Toledo Ry. & Terminal Co.* is reported to have ordered six locomotives from the American Locomotive Co.

*The Atchison, Topeka & Santa Fe* has ordered two locomotives of special design from the American Locomotive Co.

*The Minneapolis, St. Paul & Sault Ste. Marie* has ordered three 10-wheel locomotives from the Baldwin Locomotive Works for February delivery. These engines will weigh about 156,000 lbs., with 116,000 lbs. on the drivers. The cylinders will be 20 x 26 in. and the driving wheels 69 in. Extended wagon top boilers will be used, carrying 200 lbs. steam pressure and having 312 charcoal iron tubes 2 in. in diam. and 14 ft. long. The fire-boxes will be 108 5/16 in. long x 41 in. wide. The tenders will have a capacity for 6,000 gals. of water and 10 tons of coal. The special equipment includes Westinghouse air-brakes, Taylor iron axles, Gollmar bell ringers, Streeter brake-shoes, Pyle-National electric headlights, Monitor and Metropolitan injectors, Jerome metallic piston and valve rod packings, Crosby safety valves, Leach sanding devices, Chicago lubricators, Charles Scott's springs, Utica steam gages, Consolidated Car Company's system heat equipment with McLaughlin flexible joints, Krupp driving wheel tires, Standard truck and tender wheel tires, Little Giant blow-off cocks, Ajax metal bearings, Keasby & Mattison magnesia lagging, Boyer speed recorders, Washburn couplers with Westinghouse friction draft gear on tender and Leeds folding coupler on pilot.

## CAR BUILDING.

*The Wheeling & Lake Erie* is in the market for 2,000 cars.

*Nelson Morris & Co.*, Chicago, are in the market for 100 refrigerator cars.

*The Iowa Central* is having two coaches built by Harlan & Hollingsworth.

*The Lake Shore & Michigan Southern* is in the market for 1,500 box cars.

*The El Paso & Southwestern* is having 25 cars built by Haskell & Barker.

*The Green Bay & Western* is having 75 freight cars built by Haskell & Barker.

*The Mexican Central* is having three coaches built by the Barney & Smith Car Co.

*E. A. Buck & Co.* are having two freight cars built by the Youngstown Car Mfg. Co.

*The Cumberland & Pennsylvania* is having one coach built by Harlan & Hollingsworth.

*The Illinois Central* has ordered 1,000 coal cars from the American Car & Foundry Co.

*R. L. Coyer & Co.* are having five freight cars built by the American Car & Foundry Co.

*The Standard Steel Works* are having one freight car built by the Middletown Car Works.

*The Seaboard Air Line*, it is stated, will build 200 freight cars at its Portsmouth shops.

*The Pennsylvania*, it is reported, is asking bids on 1,000 additional steel and wood freight cars.

*The Milwaukee Gas Light Co.* is having one freight car built by the American Car & Foundry Co.

*The Terre Haute & Indianapolis* is having 200 freight cars built by the American Car & Foundry Co.

*The Maryland & Pennsylvania* is having five freight cars built by the South Baltimore Car Works.

*The R. W. Hunt & Co.* is reported asking prices on 1,000 steel coke cars said to be for Joseph Leiter.

*The H. J. Heinz Co.*, Pittsburgh, Pa., is having five freight cars built by the Middletown Car Works.

*The Colorado Springs & Cripple Creek* has ordered 100 box cars from the American Car & Foundry Co.

*The Northern Pacific* is reported to have ordered 225 logging cars from the South Baltimore Car Works.

*The Iowa Central* will build 100 stock cars in its shops; it is reported that 200 additional will be built at an early date.

*The Pere Marquette*, it is reported, has ordered 12 combination coaches from the American Car & Foundry Company.

*The Belington & Beaver Creek*, of West Virginia, is asking bids on 500 coal cars. H. E. Weaver, Marquette Building, Chicago, is President.

*The Chicago, Burlington & Quincy* is in the market for 800 box cars, and a large number of coal and flat cars. It is said from 2,500 to 3,000 will be ordered.

*The Colorado & Southern* has ordered 100 box cars from the American Car & Foundry Co. They will have American steel bolsters and trucks, Monarch brake-beams and French springs.

*The Vandalia* has ordered 200 wooden coal cars of 80,000 lbs. capacity from the American Car & Foundry Co., November and December delivery. These cars will be 33 ft. long and 8 ft. 4 in. wide inside, and the sides will be 3 ft. 8 in. high. The special equipment includes Shickle, Harrison & Howard cast steel bolsters, National-Hollow brakebeams, Westinghouse air-brakes, Tower couplers, Graham draft rigging and Morris journal box lids.

## BRIDGE BUILDING.

Akron, Ohio.—Bids are wanted, Oct. 12, for a bridge at Cherry street. C. H. Isbell, Clerk, Board of Commissioners.

Altoona, Pa.—The city is considering building a bridge over the railroad tracks between Tenth and Twelfth streets.

Benton Harbor, Mich.—It is reported that the Mayor of Benton Harbor, and officers of the Pere Marquette and the Big Four railroads have received notice from the Secretary of War ordering the stationary bridges spanning the Paw Paw River to be removed and replaced with drawbridges.

Blenheim, Ontario.—Bids are wanted, by George M. Baird, Township Clerk, until Oct. 25, for a steel trestle.

Buffalo, N. Y.—Separate bids are wanted, Oct. 14, for the substructure and superstructure of Van Rensselaer street viaduct. Frank V. E. Bardol, Chief Engineer, Grade Crossing Commission.

Cedar Rapids, Iowa.—Proposals are wanted, Oct. 18, by the Public Improvement Committee, for a viaduct and necessary approaches on Avenue A east, across Fourth street. R. A. Wallace, Chairman.

Chandler, Okla. T.—It is said that Lincoln County will build 14 steel bridges this fall.

Cleveland, Ohio.—The Grade Crossing Commission is reported to have approved the plans made by Engineer James Ritchie for abolishing the Nickel Plate and Lake Shore & Michigan Southern crossings on Detroit street. Mr. Ritchie's plans provide an overhead crossing of the Nickel Plate tracks and an underground crossing at the Lake Shore tracks.

Connellsville, Pa.—Estimates are being prepared for the new bridge over the Youghiogheny River at Greenwood.

Eau Claire, Wis.—According to report, a new bridge will probably be built in place of the Water street bridge.

Franklin, Texas.—The Attorney General's Department has approved an issue of $13,000 of Robertson County bridge bonds.

Harrisburg, Ohio.—The Columbus & Southern Ry. will probably build a bridge near Harrisburg.

Kansas City, Mo.—George E. Kessler, Secretary of the Park Board, will soon advertise for bids, to be opened Oct. 23, for the steel work on Benton Boulevard bridge. The estimated cost is $24,000.

Kentland, Ind.—Bids are wanted, Nov. 4, for a bridge over Iroquois River, known as "State Line Bridge." Schuyler C. Jones, County Auditor.

Lampasas, Texas.—The matter has been settled in regard to two joint bridges between Lampasas and San Saba counties. County Judge D. C. Thomas will receive bids, Oct. 29, for two steel or iron bridges across Colorado River—one at Red Bluff west of Lometa; the other at Bend, 23 miles west of Lampasas. The approaches at Red Bluff will be 100 ft. at each end; approaches at Bend 270 ft. on one side and 202 ft. on the other. A certified check for $500 to accompany all bids. Each bridge will be not less than 250-ft. span.

Lansing, Mich.—The Bridge Committee recommends that steps be taken at once toward building a new bridge at Washington avenue.

Lenox, Mass.—The town is considering building a new bridge across the Housatonic River jointly with the Berkshire Street Ry. Co. The Board of Selectmen is instructed to secure estimates of bridges.

Matanzas, Cuba.—Two steel bridges and several concrete steel culverts will be needed on the road between Matanzas and Canasi, on which work will soon be begun. Address Principal Assistant Engineer, Miguel C. Palmer, Obras Publicas.

Michigan City, Ind.—Bids are wanted, Oct. 22, for a drawbridge over the harbor. F. H. Doran, County Auditor, Laporte.

Philadelphia, Pa.—Weand & McDermott have been awarded the contract by the Pennsylvania R. R. for the masonry work of the superstructure for a new bridge to replace the present old structure at Gray's Ferry. The new bridge will have a draw.

Phoenixville, Pa.—A bridge, according to report, will be built over the Pickering Valley R. R., at Ironsides, by the Schuylkill Illuminating Co., for the Montgomery & Chester Electric R. R. L. K. Perot, President.

Pittsburgh, Oregon.—See Northern Pacific, in Railroad Construction column.

Pittsburgh, Pa.—The Wilmerding Borough Council has passed an ordinance granting to the East McKeesport Street Ry. Co., the right to build a viaduct from Middle avenue to Station street in that town, to connect two lines of their road.

Princeton, Ind.—Bids are wanted, Nov. 5, for eight steel bridges. S. H. Adams, County Auditor.

St. Thomas, Ontario.—The Port Stanley Gravel Road Co. will build a new steel bridge on its highway.

Shelbyville, Tenn.—The Bridge Committee of this county has decided on placing three more steel bridges across Duck River at a cost of about $11,000. One will be at Fairfield, one at Three Forks, and one at Sim's Ford.

Springfield, Mass.—The Council is considering a communication from the New York, New Haven & Hartford regarding rebuilding the St. James avenue bridge.

Westchester, Pa.—Viewers have recommended a new county bridge over Beaver Valley Creek in East Brandywine Township. It will be built next year.

Whitesboro, N. Y.—Plans have been adopted for the footbridge over the Erie Canal at Brainerd street. John N. Partridge, Superintendent of Public Works, Albany.

Zanesville, Ohio.—Bids are wanted, Oct. 24, for the masonry for the lift-bridge across the lateral canal of Muskingum River at the easterly end of the Y bridge. J. L. Starkey, County Auditor.

### Other Structures.

Alexandria, Va.—The Southern Ry. will build a roundhouse at Alexandria at a cost of about $30,000.

Birmingham, Ala.—It is reported that the Republic Iron & Steel Co. will build a steel plant adjoining the two blast furnaces now building.

Clarksville, Tenn.—The Red River Furnace Co. has been organized, with a capital stock of $200,000, by Graham Macfarlane as President, H. R. Williams, Vice-President and R. B. Hickman, Secretary, all of Louisville, Ky. About $50,000 is now being spent on new plants and improvements to the furnace of the Clarksville Furnace Co., recently bought.

Columbus, Ga.—The contract for building the new union station in Columbus is awarded to J. A. Williams, of Hamlet, N. C. It will be a two-story structure, 50 x 233 ft., and will be used by the Central of Georgia, the Southern and Seaboard Air Line.

Danbury, Conn.—The New York, New Haven & Hartford, it is said, will build a new passenger station in Danbury in the spring.

Elizabeth, N. J.—Fire in the shops of the Central R. R. of New Jersey at Elizabethport destroyed the carpenter and paint shops and a number of passenger cars and parlor cars and the building in which they were stored, causing a loss of about $100,000.

Fort Washington, Pa.—The Reading has invited bids for a new passenger station at Fort Washington, on the Bethlehem branch. It will be a stone structure, 21 x 42 feet, with a 100-ft. shelter shed on the track front.

Fort Worth, Texas.—It has been decided that the new freight depot of the Fort Worth & Rio Grande be located on Railroad avenue, between Jennings and Taylor streets. It will be 400 x 40 ft.

Galesburg, Ill.—The Chicago, Burlington & Quincy will build a 60-stall roundhouse at Galesburg.

Kansas City, Mo.—The Metropolitan Street Ry. will build two $40,000 car repair shops.

Knoxville, Tenn.—The Knoxville Iron Co. is reported conferring with engineers in reference to building a new plant at a cost of about $450,000. T. I. Stephenson is Manager.

Monessen, Pa.—The plant of the American Tin Plate Co., will be doubled in capacity at once, at a cost of $150,000. Contracts have been let to the American Bridge Co. for structural material.

Oak Grove, Pa.—The Manufacturers' Contracting Co., of Newark, N. J., has a contract from the New York Central & Hudson River R. R., for building a brick roundhouse with 20 stalls, a 70-ft. turntable, ash pits and coal pockets at Oak Grove. The railroad company has other contracts to let at this place in the future which will include machine shops, car shops, storage buildings, and power house.

Pittsburgh, Pa.—It is announced that H. C. Frick and the Mellon interests, composing the Union Steel Company, will build at once a new $200,000 plant at Donora, on the Monongahela River.

The Matthews Woven Wire Fence Company, controlled by the Union Steel Company, will build a woven wire fence plant to cost $100,000, with 75 tons daily capacity, and the company will double the capacity of the barbed wire department by installing 32 machines. Altogether the present outlay will reach $500,000, and future improvements which the company has in view will cost between $16,000,000 and $18,000,000.

Charles T. Schoen, of the Pressed Steel Car Co., is reported as saying that he has bought 28 acres of land in the suburbs of Pittsburgh, where a plant will be built to make rolled steel car wheels.

Pocatello, Idaho.—It has been decided by the Oregon Short Line, according to report, to spend about $750,000 in building new shops at Pocatello. Plans are being made.

Quincy, Ill.—Work has been begun on the new station for the Wabash, at Sixth and York streets. The city objects to the location and wants the station at Sixth and Jersey streets, and offers the railroad company permission to build a viaduct over York street.

St. Louis, Mo.—An officer of the Terminal R. R. Association of St. Louis writes that the Association contemplates building a new station at Washington avenue, but nothing definite is decided.

San Diego, Cal.—According to report, the Atchison, Topeka & Santa Fe has for some time contemplated building shops and terminals at San Diego and abandoning those at National City.

Sheffield, Ala.—According to report, the Southern Ry. will remove its machine shops from Memphis, Tenn., to Sheffield, Ala., where the company already owns buildings built some years ago.

Texarkana, Texas.—The Kansas City Southern will, in the near future, build a large depot at Oak and Broad streets. It is said plans are being made.

Topeka, Kan.—The Atchison, Topeka & Santa Fe, according to report, will build a passenger and freight station in Topeka next spring.

Webster City, Iowa.—The Illinois Central, according to report, will build a new passenger station in Webster City, at a cost of $20,000.

## MEETINGS AND ANNOUNCEMENTS.

*(For dates of conventions and regular meetings of railroad associations and engineering societies see advertising page xix.)*

### American Railway Association.

The fall session of this Association will be held at St. Louis, on Oct. 23. Reports will be presented by the Committee on Train Rules, on Car Service, on Safety Appliances, on Standard Dimensions of Box Cars, and the Committee on Statistical Inquiry.

### American Society of Civil Engineers.

The Nominating Committee's ticket for officers for the American Society of Civil Engineers to be chosen at the annual meeting, Jan. 15, has been approved by the Board of Direction and mailed to the members. It is as follows:

President—Robert Moore, St. Louis, Mo.

Vice-Presidents—Charles C. Schneider, New York City, and John R. Freeman, Providence, R. I.

Treasurer—Joseph M. Knap, New York City.

Directors—William J. Wilgus, New York City; George H. Pegram, New York City; Richard S. Buck, New York City; William Jackson, Boston, Mass.; Edmund F. Van Hoesen, Amsterdam, N. Y.; James L. Frazier, San Francisco, Cal.

### The American Railway Association.

The fall session of The American Railway Association will be held at The Southern, St. Louis, Mo., on Wednesday, October 23, at 11 a. m. Reports will be presented by the following committees: Executive Committee; Committee on Train Rules; Committee on Car Service; Committee on Safety Appliances; Committee on Nominations; Committee on Standard Dimensions of Box Cars, and the Committee on Statistical Inquiry. Three members of the Committee on Car Service, three

members of the Committee on Safety Appliances and two members of the Committee on Nominations are to be elected.

Presidents, Vice-Presidents, General Managers, General Superintendents and other officials connected with companies that are members of the Association are invited to be present, and may order copies of the proceedings, which are furnished them at 50 cents per copy. W. F. Allen, Secretary, New York.

**Engineers' Club of St. Louis.**

The 529th meeting was held at 1600 Locust street, Sept. 18. Mr. J. A. Ockerson read a paper entitled: "The Mississippi River, Physical Characteristics and Methods of Improvement." He gave a general description of the river and of the methods used to improve navigation and prevent overflow. He gave statistics showing the traffic and tonnage on the river, and showed that while the traffic is now a much smaller percentage of the total of adjacent territory, it is still nearly as large as it was at its prime. The paper was accompanied by a large number of lantern slides, showing objects of interest along the river and illustrating methods used in its improvement.

On invitation of the President, Mr. A. V. A. Brueggeman, President of the Architectural Club, addressed the club with reference to obtaining down town quarters in conjunction with the Architectural Club and the St. Louis Chapter of the American Institute of Architects.

The 530th meeting was held, Oct. 2, President Spencer presiding. Attendance, 33 members and 21 visitors.

On invitation of the president, Mr. A. V. A. Brueggeman, President of the Architectural Club, addressed the Club, giving further information with reference to obtaining down town quarters in conjunction with the Architectural Club and the St. Louis Chapter of the American Institute of Architects. The executive committee of the Engineers' Club was authorized to confer with the St. Louis Architectural Club and with the St. Louis Chapter of the American Institute of Architects regarding arrangements for down town quarters, and requested to report at the next meeting.

Mr. William H. Bryan read the paper of the evening, entitled, "Smoke Abatement in St. Louis." Mr. Bryan gave a brief history of the movement in St. Louis, and of the prominent part taken in it by the Engineers' Club. He stated clearly the difficulties which have been encountered and the results which have been accomplished to the present time. Regarding fuels it was shown that the cost of smokeless fuels was beyond the reach of the ordinary consumers and that the problem resolved itself into burning the ordinary fuels smokelessly. Smoke preventing devices were discussed and classified as follows: Steam jets, coking furnaces or fire brick arches, down draft furnaces, automatic stokers and powdered fuels. Each in turn was described and illustrated by numerous lantern slides. It was stated that while no one device was applicable to all furnaces, some one or more would be found for each furnace which would work successfully, providing it was intelligently operated and maintained. The hope was expressed that the problem would be so effectively handled by the World's Fair authorities, as to give an object lesson to the world. Discussion was participated in by Messrs. C. E. Jones, Joseph A. Wangler and Mr. Dan C. Nugent and Eugene McQuillin, of the Citizens' Smoke Abatement Association.

## PERSONAL.

*(For other personal mention see Elections and Appointments.)*

—Mr. E. E. Smythe, General Freight Agent of the Kansas City Southern Railway, and Miss Rose Doerle, of Chicago, were married at the Manhattan Hotel, New York City, on Oct. 1.

—Mr. Henry H. Courtright, recently Chairman of the Western Trunk Line Committee, is seriously ill. About six months ago he retired from the Chairmanship of the Committee on account of ill health.

—Mr. W. Gustave Triest is to be married Saturday, Nov. 2, in New York City, to the daughter of Mr. Charles Macdonald. Mr. Macdonald, as the reader will remember, was for a long time President of the Union Bridge Company, and more recently of the American Bridge Co. Mr. Triest is an Associate of the American Society of Civil Engineers and a member of the firm of Snare & Triest, Contracting Engineers.

—Capt. William Crozier, Ordnance Department U. S. A., now on duty in New York, has been selected to succeed Brigadier-General A. R. Buffington, Chief of Ordnance, who will retire on account of age in November. Capt. Crozier was born in Ohio and appointed to the Military Academy from Kansas. He is an officer of high scientific ability and attainments and was the military representative of the United States at The Hague conference. Capt. Crozier is junior to 29 other ordnance officers, but is one of the ablest men in that department.

—Mr. H. M. Carson, Superintendent of Motive Power of the Buffalo & Allegheny Valley Division of the Pennsylvania, is 34 years. He graduated from the Lehigh University in 1889 and the same year began his railroad career in the Pennsylvania railroad shops at Altoona. His whole life has been spent with this company, rising from machinist's apprentice to assistant road foreman of engines. Then for five years (1895-1900) he was Assistant Engineer of Motive Power and left the position of Master Mechanic of the Pittsburgh Division to take his new position as stated above.

—Mr. William A. Riach, General Auditor of the Atlantic Coast Line Railroad, died of gastritis on Friday, Oct. 4, aboard the Cunarder "Umbria." Mr. Riach was 54 years old and was born at Lochaber, Scotland. His railroad career dates from 1871, when he began as a clerk in the Secretary's office of the Pullman Palace Car Company (Pullman Company). At the end of three years he became Assistant Superintendent of the same company. He had held the position of General Auditor since February, 1882. Mr. Riach's home was at Wilmington, N. C.

—Mr. A. S. Greig, the new Assistant General Manager of the El Paso & Northeastern, is of Scotch descent, having been born at Aberdeenshire, Scotland, Oct. 25, 1860. After receiving his education at Aberdeen, he came to America in 1879, and in 1881 became clerk to the Purchasing Agent of the Colorado Coal & Iron Company, now known as the Colorado Fuel & Iron Company. The following year (1882) he was transferred to the auditing department, and in 1883 became Secretary to the Purchasing Agent of the Denver & Rio Grande. This position he held until the latter part of 1885, when he went with the Colorado Midland, returning to the Denver & Rio Grande at the end of three months. Later he was transferred as Secretary to the Superintendent of Machinery, Mr. N. W. Sample. In 1896 he was appointed Trainmaster of the Santa Fe, Prescott & Phoenix, and two years afterwards became General Superintendent of the El Paso & Northeastern, his title being changed to General Superintendent and Traffic Manager in 1899. Mr. Greig received his recent appointment on Sept. 15 this year.

—Mr. William Wallace Atterbury, who, on Oct. 1, became General Superintendent of Motive Power of the Pennsylvania Lines East of Pittsburgh and Erie, is a graduate of Yale (Sheffield Scientific School) class of 1886, and his railroad career dates from that year, when he began as an apprentice in the Altoona shops of the Pennsylvania Railroad, and continued for three years (1889-1892) as assistant road foreman on various divisions. In the last named year (1892) he became Assistant Engineer of Motive Power of the Pennsylvania Lines (Northwest System), which position he held for one year, later becoming Master Mechanic at Fort Wayne, Ind., for the Pennsylvania Company. This position he held until November, 1896, and from then, until his recent appointment, Mr. Atterbury was Superintendent of Motive Power of the Pennsylvania Railroad Division of the Pennsylvania Railroad. He is a native of Indiana, having been born at New Albany, Jan. 31, 1866, is a member of the American Society of Mechanical Engineers, and has done valuable work in the railroad mechanical societies.

## ELECTIONS AND APPOINTMENTS.

*Atchison, Topeka & Santa Fe.*—The headquarters of G. E. Ayer, Division Superintendent, have been removed from La Junta, Colo., to Dodge City, Kan., where division offices have been established.

*Austin & Northwestern.*—W. R. Hamby, heretofore Treasurer, has been elected Vice-President.

*Baltimore & Ohio.*—Owing to ill health James Mosher, Assistant General Freight Agent, has resigned and Frank M. Johnson has been appointed General Eastern Freight Agent, succeeding Mr. Mosher.

W. Salomon, Chairman of the Board, has resigned and that office has been abolished. Mr. Salomon has also resigned as a Director and E. R. Bacon has been elected a Director in his place.

*Burlington & Missouri River in Nebraska.*—Allen B. Smith, First Assistant General Freight Agent, with headquarters at Omaha, Neb., has resigned.

*Chicago & Alton.*—At a recent meeting F. S. Winston was elected a Director, succeeding the late J. W. Doane.

*Cincinnati & Muskingum Valley.*—Ralph Peters, General Superintendent of the Pennsylvania Company (Southwest System) has been appointed General Superintendent of the C. & M. V., with headquarters at Columbus, Ohio.

*Cleveland, Cincinnati, Chicago & St. Louis.*—L. H. Albers has been appointed Inspector and Instructor of Train, Air and Steam Appliances, with headquarters at Indianapolis, Ind. Orders and instructions will be issued by him to employees in regard to the proper method of application and handling these devices. He will report to the Superintendent of Motive Power.

*Cleveland, Lorain & Wheeling (Baltimore & Ohio.)*—L. F. Loree has been elected President and W. R. Woodford, formerly President, becomes Vice-President.

*Durham & Charlotte.*—John H. Kennedy has been appointed Auditor, succeeding N. P. Bullard, resigned.

*Erie.*—Charles H. Bickell, heretofore Assistant Purchasing Agent, with headquarters at New York, has been appointed Superintendent of Stores, with headquarters at Susquehanna, Pa.

*Findlay, Fort Wayne & Western.*—Frank R. Garrison, heretofore Acting General Freight and Passenger Agent, has been appointed General Freight and Passenger Agent.

*Florence & Cripple Creek.*—L. R. Ford has been made Vice-President, succeeding E. W. Rollins, and Traffic Manager, succeeding C. F. Elliott, resigned. W. W. Phelps succeeds W. F. Jones as Secretary, and G. W. Shannon becomes Auditor, succeeding Mr. Jones, resigned.

*Galveston, Houston & Henderson.*—J. E. O'Neil has been appointed Auditor.

*Grand Trunk.*—C. J. Crowley has been appointed Resident Engineer of the Western Division, succeeding E. French, resigned to take service with another company.

*Gulf & Ship Island.*—B. Marion has been appointed Superintendent of Pier.

*Kansas City Belt.*—M. J. Rogers, Master Mechanic, has resigned.

*Lake Erie, Alliance & Wheeling.*—R. G. Butler has been appointed General Manager, with headquarters at Alliance, Ohio.

*Louisville & Nashville.*—M. Devney, heretofore Trainmaster, has been appointed Assistant Division Superintendent, with headquarters at Evansville, Ind., succeeding S. Dunn, effective Oct. 8. W. D. Hines has been elected First Vice-President, succeeding the late A. W. Graham.

*Marietta, Columbus & Cleveland.*—F. L. Alexander will, in addition to the duties of Auditor, assume those of Secretary, succeeding C. N. Bingham.

*Michigan Central.*—W. S. Kinnear, heretofore Assistant Chief Engineer, has been appointed Assistant Division Superintendent, with headquarters at St. Thomas, Ont.

*Missouri Pacific.*—T. Fielden, Assistant Division Master Mechanic at Kansas City, Mo., has resigned.

*Ohio Central Lines.*—The position of Superintendent of Telegraph has been abolished.

*Paragould Southeastern.*—J. S. Yates has been elected Treasurer, succeeding H. W. Bivins, resigned.

*Pennsylvania.*—D. M. Perine, heretofore Assistant Engineer of Motive Power, has been appointed Division Master Mechanic at Pittsburgh, Pa., succeeding H. M. Carson. J. T. Wallis, heretofore Assistant Engineer of Motive Power at Altoona, Pa., succeeds Mr. Perine. I. B. Thomas succeeds Mr. Wallis and Mr. Thomas, in turn, is succeeded by E. Sumner as Assistant Division Master Mechanic at Renovo, Pa.

*Pennsylvania Company.*—(See Cincinnati & Muskingum Valley.)

*Pittsburgh & Ohio Valley.*—C. A. Vogt has been appointed General Auditor, with headquarters at Cleveland, Ohio.

*Quebec Southern.*—The headquarters of H. A. Hodge, President, have been removed from Rutland, Vt., to Montreal, Que.

*St. Louis & San Francisco.*—H. J. Cronin has been appointed Auditor of Disbursements; J. D. Nettleship, Auditor of Freight Accounts, and T. J. Heath, Auditor of Ticket Accounts.

*St. Louis, Iron Mountain & Southern (Missouri Pacific).*—R. P. Dalton, heretofore Assistant Division Superintendent of the Grand Trunk, has been appointed Superintendent of Terminals of the St. L., I. M. & S., with headquarters at Little Rock.

*St. Louis Southwestern.*—C. Parsons has been elected a Director, succeeding A. L. Wolff.

*San Antonio & Aransas Pass.*—W. Berry, heretofore Superintendent of Roadway and Buildings, has been appointed Superintendent Maintenance of Way, with headquarters at Yoakum, Texas.

*Southern Pacific.*—James Alger, heretofore Division Superintendent at Oakland Pier, Cal., has been appointed Manager of the Pacific System, succeeding J. M. Herbert, resigned. J. L. Frazier becomes Division Superintendent at Oakland Pier, Cal., and B. A. Worthington Superintendent of the Coast Division.

*Toledo, St. Louis & Western.*—The position of Chief Roadmaster has been abolished and that of Superintendent of Roadway created with A. Shane in charge.

*Union Pacific.*—At a recent meeting C. A. Peabody and H. H. Rogers were elected Directors.

*Vandalia Line.*—Maurice Coburn has been appointed Assistant Engineer Maintenance of Way, succeeding E. L. Shaneberger.

*Wisconsin Central.*—At a meeting, held Oct. 8, W. F. Vilas and J. S. Dale were elected Directors.

## RAILROAD CONSTRUCTION.

### New Incorporations, Surveys, Etc.

BAINBRIDGE & NORTHERN.—Building is reported on a railroad in Georgia, about four miles, to reach the property of the Flint Lumber Co., near West Bainbridge. The new line is to be a branch of the Bainbridge Northern, of which Charles H. Caldwell, of Bainbridge, is President.

BLUE RIDGE.—This company has been permitted to amend its charter in South Carolina so as to provide for an extension from Walhalla to the Georgia State line, and it is thought that work will begin very soon. (Aug. 9, p. 568.)

BRITISH COLUMBIA SOUTHERN.—Contracts have been let as follows for construction of the British Columbia Southern road to connect with the Great Northern branch line north from Jennings, Mont., to the International boundary: First six miles, all steam shovel work, to Twohey Bros., of Spokane; second section, Burns & Chapman; third section from Elk River to Elko, six miles, to Poupowe & McVeigh; fourth section, three miles, steam shovel, to Grant Smith; fifth section, two and one-half miles of rock work, to J. G. McLean, of Seattle; sixth section, two miles of rock work, to W. S. McLean, of Nelson, B. C.; seventh section, two and one-half miles of rock work, to Foss & McDonald, of Slocan; eighth section, five miles, to Breckenridge & Lund. The balance is being located.

CANADIAN NORTHERN.—Engineer Armstrong has been sent to Prince Albert, N. W. T., to make an exploration survey from there westward. The line is now being located from its present terminus at Erwood, Saskatchewan District, to Prince Albert, 178 miles, air line, and as soon as this is completed all three of the surveying parties will join work on the new extension.

The statement is made that this road will build the proposed branch to Ely, Minn., to connect with the Duluth & Iron Range and thus gain access into the United States. This branch, on which work has already been begun, will be 45 miles long.

A line has been laid out from Emerson, Manitoba, to connect with the Great Northern at the International boundary. Grading is to be pushed as fast as possible, and connections made as soon as they can be. The iron bridge over the Red River is now in the control of this company and will be rebuilt and put into shape as a railroad bridge.

CANADIAN ROADS.—It is stated that on the completion of the Cape Breton Extension, a road will be built by the Vanderbilts from Mulgrave to Halifax; also a line along the south shore of Nova Scotia to make connection with the Dominion Atlantic Ry. & S. S. Co., which runs between Yarmouth and Boston.

CHICAGO & NORTH WESTERN.—This company expects to complete the grading and track laying for the second track between Boone and Maple River Junction, Iowa, 55 miles, and from Missouri Valley to Denison, 42 miles, before winter. The weather has been favorable for grading all summer, and the company has taken advantage of it to push the work of construction. When these two sections are completed the North Western will have a complete double track from Chicago to Council Bluffs, Iowa, with the exception of a gap of 30 miles between Maple River and Denison, Iowa.

Track laying on the extension between Sioux City and Sergeant Bluffs, Iowa, was reported as beginning Oct. 2, and is to be pushed as rapidly as possible. (July 26, p. 540.)

CHICAGO, BURLINGTON & QUINCY.—The proposed route of this company's extension from Guernsey, Wyo., to Salt Lake, passes through the counties of Laramie, Albany, Carbon, Sweetwater and Uinta, in Wyoming.

CHICAGO GREAT WESTERN.—It is said that the grading on the extension from Sioux City to Fort Dodge will begin this fall near Anthon, in Woodbury County, Iowa. The work at this point is the heaviest on the line and it is desired to have it done early next year, concurrently with the rest of the road. (Aug. 2, p. 554.)

CHICAGO, ROCK ISLAND & PACIFIC.—Work is reported begun on the second track of this line between West Liberty and Iowa City, Iowa, 16 miles. There are 500 men and 100 teams at present engaged in grading.

EL PASO, PHOENIX & SOUTHERN.—This company has been incorporated in Arizona, with a capital of $10,000,000, to build 500 miles of railroad between Benson and Yuma.

ESCANABA & LAKE SUPERIOR.—This line is to build an extension about 15 miles north of Northland, and expects to have it completed so that it can be used during the coming winter for logging purposes. The Escanaba & Lake Superior runs from Escanaba, Mich., in a northwesterly direction between the Escanaba and Ford rivers, 41 miles, and was completed in 1900. The Chicago, Milwaukee & St. Paul has joint use of the section between Channing and Escanaba.

FISH RIVER.—An officer writes that the route of this line, incorporated in Maine, Sept. 23, is from Ashland through Portage Lake, Eagle Lake and Wallagrass plantations, to Fort Kent, Me., due north about 50 miles. Surveys are in progress but no plans have been completed yet for building and no contracts have been let. (Oct. 4, p. 690.)

FLORENCE, VICTOR & CRIPPLE CREEK.—Surveys are reported completed for a new line between the points named in Colorado. The route from Florence to Victor is 35 miles long, one mile shorter than the Florence & Cripple Creek road now building. The maximum grade of the entire line is 2.9 per cent., and the maximum curvature 12 deg. The first 20 miles north of Florence will be very light work, and of the remaining portion there are but 10 miles where the work will be heavy. The company expects to begin work next spring.

GOSHEN SOUTHERN TRACTION.—This company was incorporated, Sept. 3, in Indiana, with a capital stock of $50,000, to build an electric road from Goshen, 12 miles south to Syracuse, Ind., with further extension contemplated. The incorporators are: Louis M. Latta, Lou W. Vail, Charles A. Wehmeyer, Martin V. Starr and Joseph A. Beane.

GRAND TRUNK.—This company will have a double track between Toronto and Montreal, with the exception of a short section less than 30 miles long between Whitby and Port Hope, when the work now in progress on the grades between Port Union and Whitby is finished. The bridge over the Rouge River has been raised to the new level and the grading mentioned is almost completed.

GREAT NORTHERN OF CANADA.—A contract has been signed with the Pacquet Construction Co., of Quebec, for a line from St. Catharines, Que., on the line of the Quebec & Lake St. John, 52 miles southwest to Garneau Junction. This cut-off will shorten the distance between Quebec and Garneau Junction very greatly, by avoiding the present detour to Riviere a Pierre, and it will also remove a number of difficult curves and grades.

HAVANA & PINAR DEL RIO.—It is said that this road will at once build the proposed extension of its line from Pinar del Rio westward through the San Juan Martinez tobacco district to deep water near the straits of Yucatan. This extension involves about 50 miles of road, and it is said that work will begin next month.

HAWKINSVILLE & FLORIDA SOUTHERN.—The extension from Pitts, Ga., northeast to Hawkinsville, 25 miles, is completed. Eleven miles of track have been opened for business on the Fitzgerald Branch, which was projected from Davisville, Ga., on the main line, by way of Fitzgerald to Ocilla, about 18 miles.

KANSAS CITY, PARKVILLE & ST. JOSEPH (ELECTRIC).—Franchise has been granted to this company to build its line through Buchanan County, after having the application presented a number of times. Franchises through the intervening counties between Kansas City and St. Joseph have been secured already. In accordance with the terms of the franchise just granted, the road is to be completed within two years, the fare charge is not to exceed 2 cents a mile, and steam is not to be used at any time as a motive power. The total distance proposed is about 50 miles.

LAKE SHORE ELECTRIC.—The consolidation of electric railroads between Cleveland and Detroit, in the interest of the Everett-Moore Syndicate, was authorized by the Secretary of State on Sept. 25. The line is to be known as the Lake Shore Electric and is capitalized at $6,000,000. It includes the Lorain & Cleveland, Sandusky & Interurban, Sandusky, Norwalk & Southern, and Toledo, Fremont & Norwalk Companies, in addition to which the Syndicate already owns the Toledo & Detroit Traction Co., which gives a through line to Detroit. The directors of the new company are as follows: B. Mahler, J. B. Hanna, H. A. Everet, E. W. Moore, C. H. Stewart, James B. Hoge Price, of Norwalk, and J. Horace Harding, of Philadelphia, Pa. (Aug. 16, p. 582.)

LEHIGH & NEW ENGLAND.—An officer writes that the surfacing has been begun and that the grading is completed on the extension from the slate region in Pennsylvania, through the cement belt to the Lehigh River. Between five and 10 miles of the line are finished, and there are 400 men at work. The maximum grade is 2 per cent., and the maximum curve 6 deg. The rails and rolling stock have been purchased.

MANHATTAN (ELEVATED).—President Gould is quoted as saying that the equipment of the lines with electricity has been delayed by the contracting companies in supplying machinery and material, but that some of the new trains will probably be running on the Second Avenue line in November, and that the gradual equipment of the Third Avenue and then the Ninth Avenue would follow.

MEXICO ROADS.—A concession has been granted for a railroad to run from the Custom House in the City of Mexico, to the southern end of the valley. There are to be about 30 miles of track, and the population which the line reaches is very considerable.

MILLER COUNTY R. R.—This company was incorporated Oct. 1, to build a line three miles long, to run between the Lebanon Branch of the Missouri Pacific, near Alden, Mo., and the new line which is being built in that vicinity. The company is capitalized for $50,000, the majority of which is owned in Chicago, and is designed to furnish the railroads in question with coal from the Republic mines.

MINNESOTA ROADS.—It is said that a standard gage logging road will be built from a point half way between Solway and Shevlin, Minn., to a point 14 miles south in the neighborhood of Lake Itasca. T. B. Walker is interested and owns much lumber lands at the terminus of the proposed road.

MOUNT ROGERS & EASTERN.—Plans have been outlined by this company to build about 400 miles of railroad in Virginia. The road is to be extended from the coal mines in the southwestern part of the State, to a terminus at tidewater on the James River. Arthur Meigs, formerly the General Manager of the Atlantic, Suwanee & Gulf, is one of the promoters.

MUNISING.—An officer writes that the proposed extension mentioned Sept. 27, p. 676, is on the east branch of the road, northeast across the Duluth, South Shore & Atlantic, and thence east, a total distance of about 15 miles. The contract has been let, the material is on the ground and it is thought that the line will be completed in December.

MUSCATINE NORTH & SOUTH.—It seems very probable that the projected extension of this road from Elrick Junction to Burlington, Iowa, will be built. The route has been definitely located and right of way practically all secured northward from Burlington along the Mississippi River to Fordney's Lake, at a point where the line between Benton and Jackson townships strikes the north line of Burlington Township; thence due north through Jackson Township to the south line of Huron Township, near Bradley's Lake, and thence northwest to Elrick Junction. It is now thought that work will begin before winter. (Aug. 30, p. 612.)

NEW ORLEANS & NORTHEASTERN.—It is said that this company has let the contract to T. M. Dodson & Son, of Jonesboro, Ark., for the extension from Bastrop, La., northwest to El Dorado, Ark., about 50 miles.

NORTHERN PACIFIC.—Bids have been asked for building 20 miles of railroad between Scappoose and Pittsburg in Columbia County, Ore. The profile of plans shows that the work will be heavy and that one tunnel 1,120 ft. long is to be built. The contracts include cuts, fills, trestle work, bridges and culverts, as well as the usual ballasting work and track laying. Surveys of this route were finished last May.

PENNSYLVANIA.—A new branch of the Bedford Division has been opened from Bedford, Pa., nine miles north to Cessna.

PONTIAC PACIFIC JUNCTION.—It is said that this line which is under construction between Hull and Aylmer, Que., 10 miles, will be completed this month, and running into the central station at Ottawa by Nov. 1.

RALEIGH & WESTERN.—It is said that 15 miles of the proposed extension of this line from Chatham, Ga., have been graded as far as Harpers, on the border of Chatham and Randolph Counties. The extension in question opens up several important coal mines.

REDONDO & HERMOSA BEACH.—This company has been incorporated in Arizona, to build a railroad from Redondo to Ballona, 10 miles distant, at an estimated cost of $400,000. B. N. Pratt, of Phoenix, Ariz., is interested.

RIO GRANDE WESTERN.—Surveys are reported in Utah, from this company's line across Emery and Grand counties to the Emery county coal fields and the Green River oil country. The new line is to cross the Green River just below its junction with the San Rafel.

ST. LOUIS & SAN FRANCISCO.—Notice of the definite location of a line to be built from Chandler, Okla. T., on the Oklahoma Division, 55 miles east to Okmulgee, has been filed with the Secretary of the Creek Nation. It is also stated that right of way is being secured for an extension south and west from Mansfield, Ark.

ST. LOUIS TERMINAL.—An officer writes that this proposed belt line around St. Louis is projected for a distance of 18 miles, five of which, from Bulwer and Currie avenue, to the Wabash R. R., are under contract and four miles have been graded. (Construction Supplement, March 8, 1901.)

ST. LOUIS SOUTHWESTERN.—An officer writes in regard to the proposed extension from the Fort Worth branch south to Dallas, Texas, that surveys have been completed, but nothing else has as yet been done. (Sept. 27, p. 676.)

SANTA FE CENTRAL.—This company, which was originally called the Santa Fe, Albuquerque & Pacific, in accordance with its incorporation July 17, is to run from Santa Fe, 40 miles southwest to San Pedro, N. Mex., and thence southeast by way of the salt lakes to a connection with the projected Chicago, Rock Island & Pacific and El Paso & Northeastern roads at or near Pinos Wells, which is about 80 miles from San Pedro on the survey. The incorporators are: Willard S. Hopewell, Hillsboro, N. Mex.; William H. Andrews, Pittsburgh, Pa.; John T. McLaughlin, San Pedro, N. Mex.; Joseph E. Saint, Albuquerque, N. Mex.; Chas. W. Dudrow, Santa Fe, N. Mex. (Sept. 26, p. 660.)

TEMISCAMINGUE.—The engineer in charge of the Government survey of this road reports that the line has been located 25 miles north from North Bay, Ont., and that a preliminary survey has been made for four miles beyond. The route is said to be very good.

TENNESSEE LAND, LUMBER & MINING CO.—It is said that this company will build a railroad from McMinnville, Tenn., to the property owned by them, about 30 miles distant, in Warren County.

UNION PACIFIC.—The Chief Engineer has presented an adverse report in regard to the construction of the cut-off across Salt Lake from Ogden to Lucin, on the ground that the structure will be endangered by the frequent changes which occur in the level of the lake. (See Sept. 13, p. 644, under Southern Pacific.)

## GENERAL RAILROAD NEWS.

AKRON BELT LINE.—In accordance with an agreement filed with the Secretary of State in Ohio Sept. 30, the Akron & Barberton Belt Line and the Akron South Side Belt have consolidated under the name of the Akron Belt. The capital of the new company is $25,000 issued for stock in the old companies, share for share. The Akron & Barberton was incorporated April 5, with a capital stock of $15,000, to maintain in connection with the Akron South Side Co., a belt line around the city of Akron. The officers of the new company are: President, Charles W. French; Vice-President, C. D. Crouch; Secretary, V. A. Dehnell, and Auditor, W. W. Pope. (Railroad Construction, April 12, p. 259.)

ATKINSON-NIOBRARA RIVER.—Arrangements are being made for the issue of $250,000 worth of bonds to build this road, which is to be a narrow gage line extending 34 miles from Atkinson to Butte, Neb. Twenty-three miles have already been graded and only 12 miles of grading remain, and it is thought that the work can be completed within 40 days after it is begun. (Railroad Construction, May 10, p. 323.)

CANADIAN PACIFIC.—At the annual meeting, Oct. 2, the shareholders approved of the leasing of the Columbia & Arrowhead, the Vancouver & Lulu Island and the British Columbia Southern railroads, and the leases were confirmed. Traffic agreements with the Duluth, South Shore & Atlantic, and the issue of debentures on a number of branch lines was also approved. The directors were authorized to set aside $250,000 as a nucleus for a pension fund for employees, and to issue bonds to the extent of $2,400,000 for the acquisition of two more steamers in their equipment, one for the Yukon trade, 280 ft. long, and the other for the route between Victoria and Vancouver, to be of 1,500 tons.

CHICAGO, BURLINGTON & QUINCY.—The statement just issued for the two months ending Aug. 31, shows gross freight earnings as $6,288,398, and gross passenger earnings as $2,374,388, an increase respectively of $852,807 and $139,704 over the same months last year. After deduction of fixed charges, operating expenses, etc., the resulting net earnings from all kinds of traffic for the two months of 1901 were $2,260,772, an increase of $655,321 over last year.

CINCINNATI, GEORGETOWN & PORTSMOUTH.—This narrow gage line, which extends from Columbia, near Cincinnati, to Georgetown, Ohio, 42 miles, was bought Oct. 2, in the name of Comstock Bros., of Detroit. The price is said to have been about $400,000, and it is stated that the road will be converted into an electric line and extended to Ripley and beyond.

COLUMBUS, KINKORA & SPRINGFIELD.—This steam road, which extends from Kinkora, N. J., to New Lisbon, in Burlington County, 15 miles, is advertised for foreclosure sale at Mt. Holly, N. J., Oct. 19. Henry G. Loughlin, of 1116 Stephen Girard Building, Philadelphia, is Master, and the sale is to take place under order of the United States Circuit Court. The Columbus, Kinkora & Springfield was leased in 1889 by the Pennsylvania, and, according to the terms of the lease, the latter was to terminate on six months' notice from either party.

EEL RIVER.—The following are the directors of the new Logansport & Toledo Co., which was organized to take over the Eel River: James McCrea, J. J. Brooks, L. L. Gilbert, E. B. Taylor, J. M. Schoonmaker, J. G. Robinson and F. A. Deane, all connected with the Pennsylvania.

HAWAII ROADS.—The bonds of the Hilo R. R. are to be replaced by a new issue, the trust deed covering the entire road and the terminal facilities at Hilo. The deed to secure an issue of $1,000,000 6 per cent. bonds will be transferred to the holders of the old debentures. The bonds which the new issue will replace are in two sets. One for $450,000 is covered by a deed of trust upon the main line of the road which is known as the Hilo & Puna Division. The Olaa Division, which is the shorter line running through the Olaa Plantation, is also bonded to the extent of $150,000. The proceeds of the new bonds are to be devoted to improvements of the company's property, including a new line from Hilo to the Hilo mill, with a possible branch, two new bridges, projected docks, and also a belt line around the harbor.

KANSAS CITY, CLINTON & SPRINGFIELD.—At the shareholders meeting Sept. 24, the purchase of the line extending from Arcadia, Kan., to Sprinfigeld, Mo., 87 miles, was ratified. The line in question is owned by the Kansas City, Fort Scott & Memphis, and the action is a legal step in the absorption of the latter road by the St. Louis & San Francisco.

PHILADELPHIA, WILMINGTON & BALTIMORE.—The Pennsylvania offers the minority shareholders of this company $100 a share for their stock, of which the par value is $50, or three shares of Pennsylvania stock (worth $150) for two (worth $100) of Philadelphia, Wilmington & Baltimore. This is to effect the consolidation of this company with the Baltimore & Potomac.

PORTLAND & PUGET SOUND.—This property was sold, Nov. 24, on an execution issued in favor of the Seattle & Montana. The amount of the judgment, we understand, was $1,701,620, and the property was bid in for $200,000, including real estate, franchises, rights of way, etc., and also the superstructure, piers, etc., of the proposed bridge across the Columbia River at Vancouver.

SOUTH SHORE.—It is said that a meeting of the shareholders is to be held to authorize the bonding of the road from St. Lambert to Levis, to the extent of $20,000 a mile, for purposes of equipment and reballasting of the line among other things. The bonds are to be 4 per cent. and will run for 50 years.

TORONTO STREET RY.—At a meeting of the directors, held recently, this company adopted a resolution to increase the stock $1,000,000 in order to purchase the Metropolitan & Toronto Suburban Electric Co. The Metropolitan is a standard gage line which runs from Toronto to Newmarket, 30 miles, and will connect with the New Schomberg & Aurora Electric Road now building. Its terminal in Toronto is only a few yards from the terminal of the Toronto Street Ry. line. C. D. Warren of Deer Park, Ont., is President of the Metropolitan.

UNION PACIFIC.—The report for the two months ending Aug. 31 of the Union Pacific system, including the Oregon Short Line and the Oregon Railroad & Navigation Co., shows gross receipts of $8,072,287, an increase of $588,023 over the returns for the same period last year. The expenses, including taxes, this year were $4,246,062, an increase of $34,693 over last year, which leaves a surplus of $3,826,225, as against $3,272,895. Last year there were 5,679 miles of road operated, and this year the mileage has been increased to 5,721.

UTICA & MOHAWK VALLEY.—This company was formed on Sept. 27, by a consolidation of the Utica Belt Line, the Utica & Suburban, Utica & Mohawk, Utica & Deerfield, and Herkimer, Mohawk, Ilion & Frankfort electric roads, comprising about 40 miles of line in the vicinity of Utica.